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Popular Mechanics



MINI OFFICE IN A CHEST

organizes your paperwork—
conceals it when closed.
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- How to troubleshoot a water heater
- How to limb and fell a tree
- How to close a vacation home
- How to install stereo speakers in your car



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King Size, 17 mg. "tar," 1 .2 mg. nicotine; Long Size, 18 mg. "tar," 1 .3 mg. nicotine av. per cigarette, FTC Report Feb. 73

One of a continuing series. **Remington Reports**

Most automatic rifles are as accurate as you are... for at least the first shot. But what about the second? And the third?

Automatic rifle accuracy starts with your ability to recover from the first shot's recoil. Here's how the Remington Model 742 WOODSMASTER helps... straight from the men who designed it.

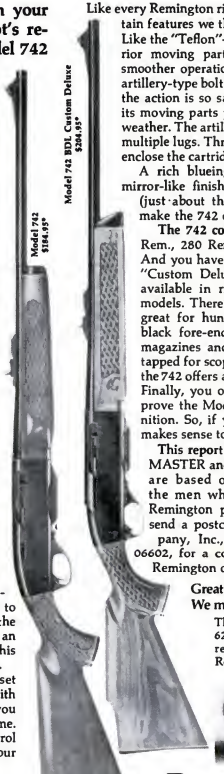
The real key to hunting accuracy with an automatic is its speed of operation. If the rifle ejects and chambers cartridges too quickly (which is often the case), most hunters have a hard time recovering from recoil and barrel whip. If the rifle operates too slowly, a hunter may lose the extra-shot advantage he bought the rifle for in the first place. Somewhere between "too fast" and "too slow" is an optimum. So the Remington designers set out to build a truly automatic rifle with an optimum rate of operation... a rate that would let a hunter make the most of the accuracy built into the rifle. The result of their efforts is the Remington Model 742.

The 742's rate of operation is engineered to help a hunter fire several shots quickly and maintain his sight plane from shot to shot, without changing position or grip. This rate is fast enough to maintain the automatic advantage... yet slow enough to give the hunter a big edge in his recovery from recoil. Which leads up to the second big reason why a rifle's operating speed is important: recoil reduction.

If the rifle mechanism operates too fast, a recoil reduction system really doesn't have a chance to be effective. And if the rate is too slow, it isn't needed because the hunter has plenty of time to recover... at the expense, perhaps, of additional shots. Essentially, the system in the Model 742 operates like most other automatic rifles. But here's where Remington designers used some engineering imagination.

The recoil force is more than required to operate the mechanism... and more than enough to give you a jolt. So by capturing the peak of the recoil force in what Remington designers call an "Inertia Sleeve", that peak recoil force is split. This means you receive a softened initial recoil **push.**

Now the real advantage is obvious. You're set for your next shot quicker with the 742 than with other types of rifles. And the more experience you have with the 742, the steadier you should become. That means greater control. And greater control means you have a better chance of keeping your sight picture from shot to shot.



Like every Remington rifle and shotgun, the 742 has certain features we think you'll want to know about. Like the "Teflon"-5** coating we've added to interior moving parts. The result is longer wear, smoother operation and easier cleaning. And the artillery-type bolt locks up safe and strong. In fact, the action is so safe and strong that the 742 and its moving parts perform effortlessly despite bad weather. The artillery-type bolt locks up tight with multiple lugs. Three rings of solid steel completely enclose the cartridge head.

A rich blueing, "vibra-honed" parts with a mirror-like finish, Du Pont RK-W wood finish (just about the most rugged finish available) make the 742 owner a proud one.

The 742 comes in five great calibers: 6mm Rem., 280 Rem., 30-06, 308 Win., 243 Win. And you have your choice of an ADL or BDL "Custom Deluxe". The BDL, incidentally, is available in right- and left-hand cheekpiece models. There's an 18½" barrel carbine that's great for hunting in brush, too. All feature black fore-end caps, white line spacers, clip magazines and receivers that are drilled and tapped for scope mounts. Priced from $184.95*, the 742 offers a hunter tremendous dollar value. Finally, you ought to know that we test and prove the Model 742 with Remington ammunition. So, if you're after top performance, it makes sense to use Remington ammunition.

This report about the Model 742 WOODSMASTER and all other "Remington Reports" are based on information straight from the men who design and engineer every Remington product. For even more details, send a postcard to: Remington Arms Company, Inc., Dept. 353, Bridgeport, Conn. 06602, for a copy of our free 1973 full-color Remington catalog.

Great guns deserve great ammunition. We make both.

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*Prices shown are suggested minimum prices, subject to change without notice. **Reg. U.S. Pat. Off. for Du Pont's non-stick finishes. "Remington", "Woodsmaster" and "Core-Lokt" are trademarks registered in the U.S. Pat. Off.

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If you're a motorcycle owner, you probably know all about NGK performance. You sports car types do, too. But NGK's work just as great in utility and recreational vehicles. And they'll fire-up your hairy V-8 as quick as your one-lunger saw.

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For some reason people think the more additives you put into your car's crankcase, the more you'll get out of your car. The fact is, it could work out just the opposite.

Some additives may thicken the oil to the point that it becomes harmful. Especially in cold weather when thickened oil can lead to increased engine wear.

Also, when the electrolyte fluid in your battery is cold, its output is lower. That, with hard cranking because of thickened oil, can cause hard starting, which puts a strain on your battery.

In addition additives don't remove contaminants. Only an oil change will remove contaminants.

The truth is you don't need supplemental additives. All they can do is cost money. If you want your engine to run well, don't add things to your crankcase. Put in a good quality motor oil to begin with, and change your oil according to the auto manufacturer's recommendations, and you'll be giving it all it needs. Because a good oil already has special additives in it. The same type that some people try to make you pay extra for.

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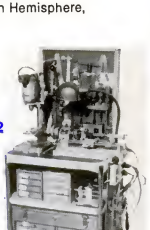
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Australia, Caribbean, Denmark, Mexico, Southern Hemisphere, Sweden



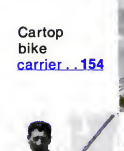
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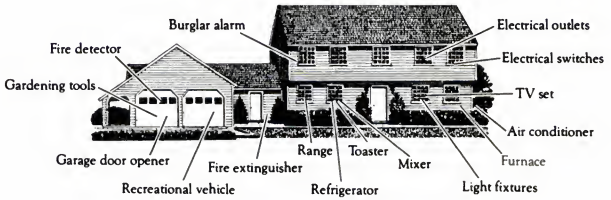
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ON THE COVER: The Swing-Wing—mini office in a chest (inset)—one of three original desks for the home designed by PM editors and featured in this issue. *Photos by George Ratkai*

AS A SERVICE TO READERS, *Popular Mechanics* publishes newsworthy products, techniques and scientific and technological developments. Due to possible variance in the quality and condition of materials and workmanship, *Popular Mechanics* cannot assume responsibility for proper application of techniques or proper and safe functioning of manufactured products or reader-built projects resulting from plans published in this magazine.

In your home you have this symbol (UL) by the dozen. Do you know what it really means?



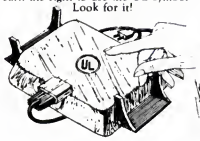
Here's how a product earns the UL symbol.



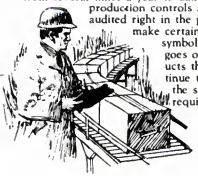
Submittal. A manufacturer turns his product over to UL for evaluation. He wants UL to verify by examination and test that the design meets recognized safety requirements.



Testing. UL engineers put the product through normal use tests, then tests far more rigorous. They want to determine it is adequately safeguarded against electric shock, fire and casualty hazards.



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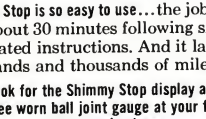
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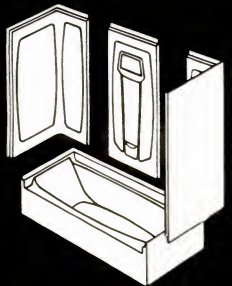
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BORG WARNER

LETTERS

TO THE EDITOR

He'll keep his '71

Congratulations on being one of the first publications to "tell it like it is" about the 1974 Mustang II (*Detroit Listening Post*, page 56, July *PM*). All the auto mags are now stating how great this revamped Pinto is going to be when it hits the dealers' carpeting this fall. Bunk. When I first saw photos of this thing Dearborn is calling a Mustang with the Mach I name on the back deck, all I could think was blasphemy!

I'm currently driving a 1971 Mustang 351 Ram-Air fastback. I consider it the best looking body shape of all the Mustangs since the 1965 model. On a recent round trip to Florida we averaged 18.5 mpg at speeds around 65 to 70 mph. The engine does not hesitate, stall, balk or give any troubles exhibited by the ill-performing '73 offerings. The *true* sporty, performance-able ponycars will probably increase in value in the future. I'm keeping mine.

GRANVILLE, MASS. DAVID W. PULASKI

PM by cassette?

Prior to my recent blindness, I had always felt a good deal of my scientific and mechanical knowledge was attributed to the pleasant hours I had spent in reading *PM*. I would very much like to continue this input if I can, and, therefore, require your assistance. Could you possibly direct me to a source whereby this information would be available either on disc or cassette? If no organization for this purpose does exist, would it be possible that one of your readers is in a position to exchange this kind of information via cassette with me?

MASSAPEQUA PARK, N.Y. GEORGE I. BEHRENS

We don't know of any group that records the contents of PM on discs or cassettes, but if there is one, we'll be glad to put you in touch with Mr. Behrens. There is a braille edition of each month's PM available through the Regional Library for the Blind. If any readers are interested in the braille

(Please turn to page 11)



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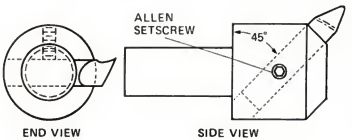
LETTERS

(Continued from page 8)

edition, information may be obtained either through the Regional Library or directly from Mr. Martin Droege, Clovernook Printing House, 7000 Hamilton Ave., Cincinnati, Ohio 45231.

Simpler fly cutter

Since I don't have the milling capacity required by *Fly-Cutter Holder You Can Make for Your Lathe* (page 172, July *PM*)—and I'm sure most people don't—I thought you might be interested in a fly cutter that's easier for the average guy to make. It can be almost any size that is required, based on available material. For cutters, I use round stock and have used pieces of broken taps, drills and drill rod that I heat-treat with a propane torch. You can modify the shape of the cutter for other uses, such as boring or spot facing around a hole.



FLORISSANT, MO. RICH BENOODT

Right war, anyway

The tank in the foreground of the photo on page 111 of the June *It's New Now* is a Cromwell, a British tank, not the Sherman. The tank in the background is a model of a latter World War II version of the Sherman.

GRAND ISLAND, N.Y. PETER GILMORE

Not so new now

The Austrians are actually behind the United States in the method of stopping a runaway truck by turning it uphill (*It's New Now*, page 117, July *PM*). In Hawaii in 1967, I saw these turn-offs along the famed Pali Highway. One improvement in

(Please turn to page 12)

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That sounds like my kind of boot. Send me your catalog and the name of my nearest Herman dealer.

PM-BGL-3-9

NAME

ADDRESS

CITY STATE ZIP

LETTERS

(Continued from page 11)

Hawaii: the use of gravel to make the truck "sink in" and stop much faster.

YELM, WASH. CHARLES E. LISBON

I am in the Army Corps of Engineers, and we employed this method in the steep mountain passes of Vietnam. In fact, it has been in use for at least 15 years.

FORT BELVOIR, VA. KENNETH DESAUTELS

Film hazard: uranium ore

Regarding the letter, "Do Security Checks Ruin Film?" in your July *Letters to the Editor* (page 8): Put your film all in one place and tell the checker, then he will not run it through the X-ray machine. At least, they have been helpful to me that way.

Another thing I learned too late: Don't take your film around uranium ore. I stopped to look at a display table of specimens in a Colorado hotel. Not until six months later, in an article I chanced to read, did I get a clue as to what happened to my film. Even the Kodak developer couldn't figure it out and sent me replacement film, thinking there was something faulty with the original batch.

CRAWFORDSVILLE, FLA. EDNA KNOWLTON

Wishes he had found Mort sooner

I recently picked up my first copy of *PM* and was surprised to find someone who can write about auto repairs in language that even I can understand. My only regret is that I was not introduced to the magazine and especially Mort Schultz's articles at an earlier date.

FLUSHING, N.Y. LAWRENCE A. NADLER

Pretty tight turn

In *Cars the Red Baron Would Love* (page 138, July *PM*) that Mercedes-Benz 450SE sounded pretty fantastic. Its turning radius is only 37.5 feet when the wheelbase is 112.8 *feet*.

NORWALK, CONN. RICHARD S. ELECK

You never saw a longer car, did you?

(Please turn to page 14)



WHATEVER YOUR PLANS, THEY PROBABLY DON'T INCLUDE TIRE TROUBLE.



Photographed at Lion Country Safari, Florida.

Steel Radial 500—we think you'll say "They're the best tires I've ever owned". • A 40,000 mile radial (that's 3 or 4 years of average driving). • Two belts of brass plated, high tensile steel cord under the tread. • Better handling and steering than any conventional tire we have on the road today. • A computer designed quiet running tread. • And six ways to charge it at most Firestone Dealers and Stores.



Let Firestone put the 40,000 mile Steel Radial 500 between you and tire trouble.

Firestone

The people tire people

LETTERS

(Continued from page 12)

(Even when you think of the wheelbase in inches, the turning radius is pretty good.)

Right down the alley

For the maintenance men of the Mechanical Dept., County of Los Angeles, your article on *How to Troubleshoot Your Airconditioner* (page 72, July *PM*) was right down the alley—there's so much of that in county buildings.

VAN NUYS, CALIF. M. R. HATTABAUGH

Pontoon Fun Raft

It took approximately one year and $650 to build my pontoon boat from your construction drawings (*Build This Pontoon Fun Raft*, page 138, March '70 *PM*). We are really enjoying it. I built it in my 20 by 20-



foot garage; I would not advise anyone doing so because of the limited space.

HOUSTON, TEX. JACK A. WARD

New autopilot

New Autopilot Got Started With Ben Franklin's Kite (page 122, July *PM*) is very well done. I think your text and article give a better description for the layman than I have been able to organize.

I consider it an honor to have the autopilot described in this way in such a popular magazine.

SILVER SPRING, MD. MAYNARD L. HILL

Coffee-Table Aquarium

While visiting friends, I saw a beautiful hexagon-shaped aquarium in one of their homes. The man who built it said he got the plans several years ago from *PM*. Would you please try to find the plans for this so I can buy them.

CLEVELAND, OHIO MRS. A. G. PALMER

We found them. You can order a photo copy of PM's Coffee-Table Aquarium *(page 150, April '68) for $1.45. Write to Popular Mechanics, Dept. CO, Box 1014, Radio City, N.Y. 10019, and ask for plan No. X19A.*

Candlestand Lamp



The *Candlestand Lamp* (page 168, Nov. '70 *PM*) was my first large lathe project, and it turned out very nicely. Instead of using two glued pieces to make the lower turning, I used four ¾-inch boards. I'm very happy with it.

ENDICOTT, N.Y. JOHN M. SCHMIDT

Splendid Hydro Dynamic

Here's the *Hydro Dynamic* (page 144, March '63 *PM*) that I built from plans I bought from you. It is a splendid boat—very stable and fast. I have a 50-hp Johnson on



it. I am now building the P38. Keep up the good work; I love to build things.

AURORA, COLO. LAURENCE MARGHEIM

Yes, we have an index

Did you put out an index for 1972 as you did in 1971? Haven't seen anything on it and would like to order one. Don't stop putting one out; it is a lifesaver in finding articles when they're needed.

PORTLAND, ORE. JIM ADAMS

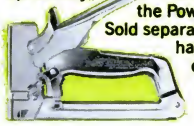
Yes, we have a PM Index and Shelf Wrapper for 1971 and 1972. Order them from Popular Mechanics, Dept. IXL, Box 1014, Radio City, New York, N.Y. 10019. They are $1.49 each. Be sure to state which year you want and include your full address. ★★★

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3 GUYS WHO DIDN'T GET A FREE RIDE THROUGH COLLEGE TELL HOW THEY BECAME ENGINEERS



BILL JOHNSON

"Get into college? After high school in Rutland, Vermont, I was glad to get into a machine shop not far away. Started as a lathe operator at 75 cents an hour. But thanks to ICS I've gone far. Studied Mechanical Engineering nights, at home. Never did take to classrooms or missed paydays. Won't say it was easy, but with the instructors' help I took it one step at a time. Today I'm Development Engineer with a paper converting plant near the Canadian border. Hunting's great. Salary's jumped 600 per cent since I started my ICS course. There's 40 men under me, future looks fine. Do I recommend ICS to my men? Yes I do."



GARY BURNASH

"Too bad, but the college I went to didn't hand out degrees in hot rodding. So after my first year my Dad and I had one of those long talks. The upshot was, it was time to get serious. So I got married, started to learn automotive tool making at Sheler Corporation outside Detroit, and signed on with ICS. They taught me everything. Print reading. Materials. Hydraulics. Even how to use a slide rule. When the boss found out, he gave me design work to take home. Pretty soon, I could talk to the big car companies in their own language. I'm making triple my starting salary now, but here's the best part—I'm a half owner in the business. If I want another raise, the man I ask is me."



JACK TERRY

"I grew up near the Okeefenokee Swamp and what that means is, you don't expect life to be a gravy train with biscuit wheels. I went to work real early with the Florida Department of Transportation as a beginner draftsman. I heard the fellows tell of ICS so I sent for the information. Before long, I got to be a First-Level Highway Engineer at twice the pay. It took five promotions but the ICS training was a real help to pass each promotion exam."

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CAR CLINIC

BY MORT SCHULTZ

Bellyache

I own the perfect car—a 1972 Fiat 128. However, dealer service shops get a ridiculous price for changing the oil, so I thought I would do it myself. My problem is that no one will tell me what size wrench I need to remove the oil plug. Can you?—James Wiercinski, New York, N.Y.

The size of the hex-head wrench you need is 12 mm, and you should be able to order one through a Fiat dealer using part No. 50113. Oil should be changed every 3000 miles and oil filter every 6000 miles. Replacing the oil filter requires removal of the belly pan on the right side, which is held by three bolts. The belly pan is a protective sheet-metal covering that runs the length of the underside of the car. A special oil-filter wrench (Fiat part No. 60312) is needed to remove and to install the filter. Fiat has published an excellent manual entitled *Fiat 128, US Version, Do It Yourself Troubleshooting and Repair Manual.* It sells for $4 and goes under part No. 8009. You can order it from a Fiat dealer or from the service department of Fiat Roosevelt Motors, Inc., 532-540 Sylvan Ave., Englewood Cliffs, N.J. 07632.

Pinged off

My 1969 Chevrolet Impala with 350-cu.-in. engine and four-barrel carburetor has developed a severe ping after 34,000 miles. The ping only occurs when the engine has been driven more than five miles and is at maximum operating temperature. I use a high-octane gasoline, have taken several high-speed trips to purge the engine of impurities, have used upper lubricants, have poured various carbon-removing additives down the carburetor and have also tried a crankcase additive. The Chevrolet dealer has tried additives, tune-ups and valve adjustments with no improvement. I am told there is nothing else to do, but tear down the engine and clean out all carbon. Is there a simpler solution?—Dr. J. Anthony Hockett, Overland Park, Kans.

You've tried all the simple solutions; now it's time to clean out the carbon.

Tailspin

We have a 1969 Ford XL with power front disc brakes. When applying the brakes in slippery weather (snowy or icy), we think the front wheels are locking up, causing the car to slide before it comes to a stop. We don't get this sensation on dry pavement. Is there anything we can do?—Mrs. Robert David, Detroit.

If rear brakes are not applying properly, it could produce a "grab" up front. I would have the rear brakes, which are drum brakes, inspected for sluggish wheel-cylinder action and worn linings.

How's this grab you?

I've found that many owners of Plymouths have been experiencing a brake-grab problem. I had the trouble with a 1969 Satellite station wagon and found that it was caused by dust accumulating on brake parts and collecting moisture. I had wheels removed and dust blown out thoroughly. The grabbing condition stopped, and I have had no further trouble although I made it a practice to have this done about once a year.—A. W. Anders, Tampa, Fla.

Thanks for this information; it may benefit many drivers who are having the same problem.

Interrupted symphony

I share a problem with other Oldsmobile owners (mine is a Toronado) and perhaps

(Please turn to page 22)



Ordinarily, moonlighting makes for a long, long day. And when the money is gone, there's often nothing to show for it.

So consider an alternative: The Air Force Reserve.

For one thing, the hours are better. We only ask you for one weekend a month. And the pay is good. Even when you're just starting with us, we'll pay you $40.96 for that weekend. Considerably more when you're with us for two weeks in the summer. Also, the promotions and raises keep coming regularly.

But there's a lot to like besides the money. Some reservists like the chance they have to learn new skills. Or sharpen old ones. Some like the companionship. Others, the idea that there's a pension waiting that no one can take away from them. And the idea that you are helping both yourself and your country at the same time.

Think about it. Then fill in and mail the coupon, or pick up the phone and call 800-525-9984, toll free (in Colorado, 800-332-9952). There'll be somebody on the job to give you the name and address of your nearest Air Force Reserve Unit. Check 'em out, because our kind of moonlighting is not only easier to take, but a lot more interesting.

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Please send me more information. I understand there is no obligation.

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Address_____

City_____

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Soc. Sec. #_____ Date of Birth_____

AIR FORCE RESERVE.
YOUR LOCAL AIR FORCE.

(Continued from page 20)

with other owners of GM cars. I get disturbing noises (clicks, buzzing) from the radio when I activate a switch or motor that operates on electricity. Is there a solution? —Harvey Kamp, Evansville, Ind.

I assume your radio is AM/FM and the antenna is in the windshield. Allow me to quote from Delco Electronics which is responsible for this component:

"The location of the windshield antenna directly above the instrument panel makes it more susceptible to pops and buzzes caused by operation of many electrical devices. Other momentary noises from owner-actuated devices, such as turn signals, power windows or brake light switches, are considered normal on weaker stations . . . A new type of interference on weak FM stations can be encountered when wiper blades pass over the antenna. A swish may be heard."

There may be a mechanical cause for your problem, but if none is found then your situation would fit right in with the Delco statement. Mechanically, make sure suppressors are tightly in place and have them checked with an ohmmeter for resistance. Also see that the instrument wiring harness extending from one side of the dash to the other isn't resting on the antenna lead.

More rapping about radios

I read in your column recently that you helped a gentleman find a place to have the radio in his foreign-made car repaired. I'm in the same boat and need your help. The car is a 1972 VW Super Beetle. The radio is AM/FM, and has a defective IC chip. Who makes the VW radio and where can I get it fixed? It is marked "made in Japan."—Paul B. Glass, Iselin, N.J.

Volkswagen does not equip cars with radios. They are installed by dealers who get them from various distributors that carry several different brands. If, for example, the name on your radio is Sapphire, the manufacturer would be Motorola. But this company is only one that has made radios supplied to VW dealers. Others are Panasonic, Sony, Clarion. My advice is this: Check back with your dealer. He should know who supplied the radio, so don't let him tell you otherwise.

Booster club

As soon as cold weather strikes (0° or lower), I have to literally stand on the power brake pedal of my 1967 Mercury Caliente to get the car to stop until it has been driven two miles. Brake fluid has been drained and a high-quality fluid put in. What do you think?—Fred Witt, Beloit, Wis.

I think your car is one of those 1967 Calientes, Comets and Cougars subject to recall for inspection and possible replacement of the brake booster unit (power brake). The trouble involves a rubber diaphragm that loses flexibility on cold days until the heat of warm-up allows it to become pliable. Although you don't say so, you probably aren't the original owner and therefore didn't receive notice of the recall. In any case, Ford has told me to tell you that a representative from their Milwaukee district office will be in touch and that if your car falls into the recall category, "arrangements will be made to have any necessary repairs made without charge."

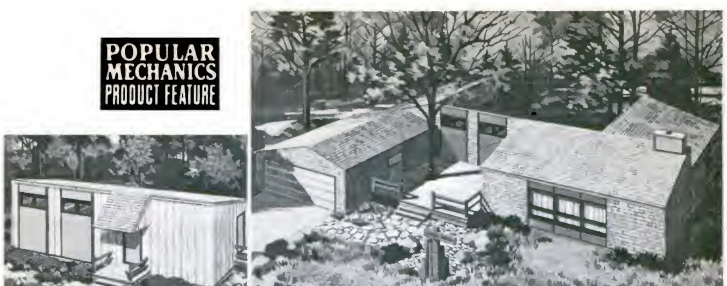
SERVICE TIPS

☐ **Owners of 1973 Chrysler Corp. cars:** A stumble (noticeable lag) on acceleration with a 340 or 400 cu.-in. engine with four-barrel carburetor, or a 440-cu.-in. engine with TQ carburetor, may be caused by an undersize accelerating pump plunger cap. If an inspection of the fuel discharge from the accelerator pump discharge jets verifies this condition, a new plunger and check-valve seat (part No. 3780111) should be installed.

☐ **Owners of 1973 Fords, Mercurys, Lincolns:** If the 8x32 ⅜-in. self-tapping screw is missing from your 4300-4V carburetor, you are probably experiencing cold-start problems. This screw plugs off the choke heat vacuum passage, preventing the engine from loading up on a cold start. If the screw is missing, get one installed under the provisions of technical service bulletin 41, page 5. ★★★

GOT A PROBLEM WITH YOUR CAR? Ask Mort about it. Send your question to Car Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of general interest will be published in the column.

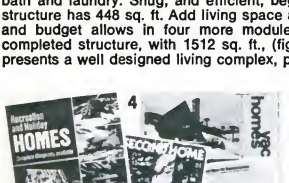
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HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Chair restoration

I have an old chair, not a genuine antique, in which the screws holding some parts have loosened and the heads are exposed, making the whole piece quite unsightly. Is there some way of concealing the heads of new screws I will have to use as replacements?—R. W. Hadley, Portsmouth, N.H.

Use what are known as screwhole buttons. These are made of hardwood and they come with flat and half-round heads. They make a neat, acceptable finish.

To apply these hardwood buttons, you counterbore to recess the head of the screw to a depth of ⅛ to ¼ in. The hole should have a diameter that will take the button with a light drive fit (the buttons are slightly tapered).

If you cannot obtain the buttons locally, write to Albert Constantine & Sons Inc., 2050 Eastchester Rd., Bronx, N.Y. 10461, or Craftsman Wood Service Co., 2727 South Mary St., Chicago, Ill. 60608.

Latex over oil paint?

My old house needs repainting. Original paint seems to be in fairly good condition, needing only to be wire-brushed and sanded here and there. But I've got a question: Can I use a newer latex paint over the old paint?—J. Hendrickson, Sioux City, Iowa.

Latex paint can be used on a surface that has been painted previously with an oil-based paint if the surface is sound, clean and dry.

Wind-damaged door

My wood combination door was flipped open by the wind and split along the hinged side. New doors are expensive. Is it possible to repair it?—E. Corbell, Memphis.

If the split or splintering is clean and can be tightly fitted back into place, a sound repair is possible. Spread waterproof glue uniformly along the length of the split, then apply a few C-clamps to bring the split together tightly. Where the split extends to the bottom of the door, you will need to use bar clamps. You can reinforce the glued joint further with corrugated fasteners spaced 12 in. apart.

Brass or plating?

How do I tell for sure if metal is genuine brass or some other metal brass-plated?—Jay Holden, San Francisco.

A magnet will show if a ferrous metal, such as steel, has been brass-plated. If the metal under the plating is steel, the magnet will be strongly attracted to it. But if the metal is all brass, which is a nonferrous metal, the magnet will not be attracted. However, there are other nonferrous metals that are sometimes plated with brass, and these pieces would not affect the magnet either.

Painting fiberboard walls

I have fiberboard walls—that's what I hear they are called—on a back porch. The paint appears to be that which was applied originally, but now the walls are in need of repainting. Should I use a latex or an oil paint?—Jim Winston, Topeka, Kans.

From your description I suppose that these walls have been made with tongue-and groove "planks," that were either prepainted or factory painted. I would prefer to use a latex paint after applying a primer of the type intended for such paint. ★★★

Do you have a home maintenance or repair problem? Send it to Homeowners' Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems of wide interest will be discussed in this column.



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HINTS

FROM READERS



Locking electric outlet

A workshop duplex receptacle can be locked for the safety of children or to prevent unauthorized use of tools by means of a T-hinge, screw eye and padlock or combination lock. It is necessary to cut a slot through the strap end of the hinge for the screw eye.—*Ken Patterson, Regina, Sask.*



Jeweler's saw without frame

A frameless jeweler's saw blade (or part of a broken one) can be useful in tight spots and for removing encrusted dirt from recesses. Make "handles" by placing each blade end between washers and clamping washers together with a short 6-32 bolt and nut.—*Walter E. Burton, Akron, Ohio*



Jumbo workshop dustpan

A large cake pan with one side cut away and a file handle screwed on makes a handy shop dustpan, can also catch lathe and drill-press chips.—*Allen Wilks, Matawan, N.J.*



Test lamp from ballpoint pens

This test lamp uses ballpoint pen barrels (Bic) as probes. With cartridges removed, brass tips are wired in series to lamp socket and plug.—*Bill Morlock, Elma, N.Y.*



Clip stops curling

To cut a narrow strip from thin sheet metal, hold stock between scrap blocks and use a spring clip after starting the cut to prevent curling.—*E. Dussault, Oak Park, Ill.*



The X1/9: Fiat has a deal you can't refuse

By the end of this year Fiat will corner the market with a safe, speedy, futuristic sports car under $3600

by Bill Hartford
AUTO EDITOR



PHOTOS BY THE AUTHOR

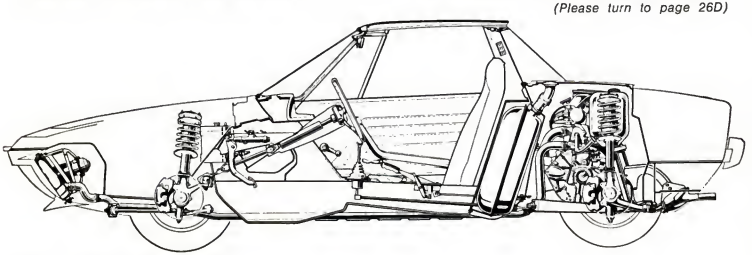
Mid-engine X1/9 is a knockout from any angle. The front spoiler on the Bertone body is not so much for aerodynamic stability as it is for directing the airstream to the front radiator. Cutaway view shows the component placement. Spare tire is behind passenger seat. Steering is worm and roller; turning circle, 32 ft. 10 in. Wheelbase is 86.7 in.; length, 150.5 in.; width, 61.7 in.; height, 46 in., and weight, 1940 lbs. Gearbox is four-speed synchromesh with fourth a .959:1 overdrive ratio. Lift-off roof panel stows in front boot. Rollover bar and differentially deformable body contribute to passenger safety. Headlights pop up.

If you watch the auto market, you know that models of many European cars jumped $1000 in less than a half-dozen years. And if you've looked longingly at a Porsche 914 recently and remember that it was $3600 only a few years ago when you didn't buy, you know you blew it!

But you've got a second chance—a second chance to get a futuristic 1970s sports car at a 1960s price. We compare it to the 914 because these are the only two-seater, mid-engine, Targa-roofed designs available; and it compares favorably to the 914 in more ways than just the lower sticker.

The X1/9 is Fiat's replacement for the 850 Spider—a car that has enjoyed great success in this country as an excellent low-priced sports car. Its

(Please turn to page 26D)



No Miracles Today!

Just a simple reminder to keep your engine properly tuned for improved gasoline mileage

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(Continued from page 26B)

production stops as the X1/9's starts. The secret of the 850's success is often seen as its Bertone styling. But I've always found the car too cute, its lines too soft, almost effeminate for my taste. The X1/9 is something else. With its distinct aerodynamic wedge shape, the car has a forward thrust that is bold and assertive. There's no "best angle" to view it; every angle delights my sense of automobile design. But beauty is in the eye of the beholder and it's up to you to turn thumbs up or down on Bertone's latest from the pictures here (the cars will start arriving in showrooms soon).

The white car shown below is parked off the road near Campofelice under a hot Sicilian sun: judiciously I stopped driving after going over my head and almost running off (and down!) one of the tight, windup turns on the tortuous, legendary Targa Florio circuit. A good time to take some pictures, I thought. My tripod kept the camera from shaking.

A more demanding route couldn't have been chosen by Fiat to show off its new car. The choice reflects the company's confidence in the X1/9. New-car press previews often wind up as destruction tests, with journalists flogging the cars unmercifully—to learn the car's capabilities, of course, but often with a child's devilish curiosity to see when it will break!

The car didn't break, or even overheat. I wouldn't have been surprised if it did after running at or above the 6800-rpm red line in the lower gears through the mountain roads, and all the way to them on the autostrada at the top speed of 105 mph.

The 1290-cc overhead-cam Four (same as in Fiat 128 models) is water-cooled, the radiator and thermostatically controlled electric fan being mounted in the nose of the car. Coolant tubes run down the center in the backbone tunnel. They are protected by the floorpan, integral with the stressed

(Please turn to page 26F)







Roll bar is discernible after the removable roof section is lifted off. Fixed-glass backlight keeps back draft out of passenger compartment at speed. In U.S. market car may be regarded as underpowered by enthusiasts who expect to smoke off the line. Styling, economy, initial purchase price are all big pluses, but most outstanding characteristic is handling. It's a car for those who love to drive. And the harder you drive it the more it will reward your skills.

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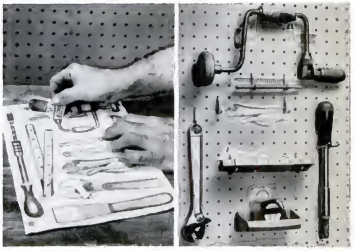
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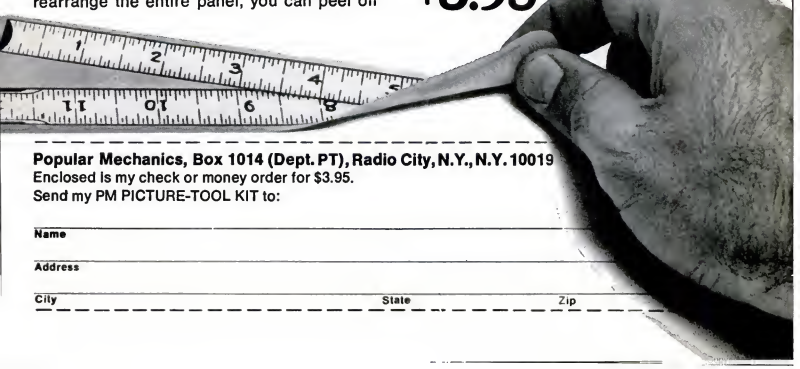
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FIAT'S X1/9

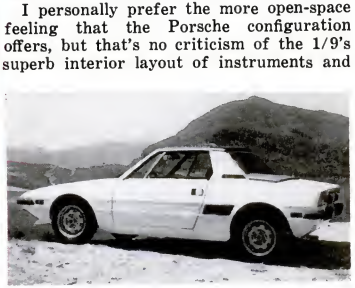
(Continued from page 26D)

body structure—an effective arrangement.

The X1/9 engine, placed transversely just ahead of the rear wheels, is rated at 75-hp DIN in the European version we drove. Net figure for the U.S. version will be lower, but top speed performance should near 100 mph and through the gears it will compare to the 128SL coupe.

Access to the single-carbureted engine is through the slotted, flat-black hatch visible in the photos. Maintenance will be easy through the wide opening, much easier than 914 owners have it. The rear luggage compartment is not as large as the Porsche's but I vote for the easier serviceability. Fiat's layout switches stowage of the removable roof section to the front.

I personally prefer the more open-space feeling that the Porsche configuration offers, but that's no criticism of the 1/9's superb interior layout of instruments and



Wheels and tires are 4½Jx13 in. and 145HR-13 radials. Dual hydraulic circuits operate disc brakes on all four wheels. Suspension is four-wheel independent.

controls, excellent driving position and seats, and interior trim. Design of the small-diameter, padded, sports steering wheel is terrific. Fiber optics light the switches and ventilation is flow-through. You can spend hours at the wheel and then regret having to stop. Unless, you've almost gone over the edge driving the route of the Targa Florio. That's the danger of being too steeped in the romance of all those superdrivers who have challenged that circuit and won. The first to do it in an international Grand Prix was Felice Nazzaro in a FIAT in 1907 (Back then FIAT was an acronym for *Fabbrica Italiana Automobili Torino*). There's nothing to match the romance of road racing! My 1973 Popular Mechanics Grand Prix of Sicily is over. I won. I beat the road. The marque: FIAT . . . X1/9. ★★★



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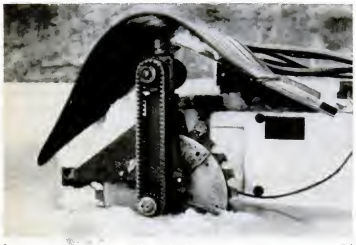
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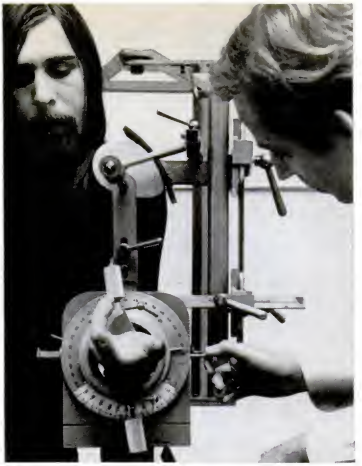
Icebreaker saws through ice

A new type of icebreaker, equipped with ice-chomping circular saws, is under development for the U.S. Coast Guard. Three saws, mounted on runners projecting forward of the bow, cut slots in the ice. As the ship





moves forward, pressure from the bow breaks off slabs that slide under the hull and are pushed to either side. Slabs come to rest under ice sheet, leaving a clear channel. Conventional icebreakers leave a channel clogged with broken ice, making passage difficult for following freighters. The concept has been tested with a one-sixth-scale model (shown) by ARCTEC, a Maryland lab specializing in cold-regions research. Results indicate a full-scale ship could clear a channel of ice two and a half feet thick at a speed of five knots. This would make it effective in assisting winter marine transportation in the upper reaches of the Mississippi and in the Great Lakes.



Measuring a musician's potential

Some musicians find that they reach a point where their technical facility no longer improves. This is due primarily to physiological shortcomings, according to Dr. Christoph Wagner, a researcher at the Max Planck Institute, West Germany. An amateur musician himself, Dr. Wagner has devised several instruments for measuring factors such as flexibility in joints and arms, and extensibility of the hands. In photo, Dr. Wagner checks flexibility of subject's hand and forearm. The doctor believes that his tests show whether a musician has the potential to become a top performer—or whether he has limitations that no amount of training can overcome.

Space communications by laser

A sun-powered laser that can provide the long life required for practical space communications systems is under development by the Air Force. It's part of a program aimed at determining the feasibility of satellite optical communications. By means of a series of lenses and mirrors, the device will collect and focus rays from the sun, stimulating material in the laser to produce

(Please turn to page 32)

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SCIENCE WORLDWIDE

(Continued from page 30)

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Most distant quasar reported

A new quasar some 10 billion light years from Earth—more distant than any other known object—was recently reported by University of California astronomers. Quasar stands for "quasi-stellar radio source," a bright object that emits powerful radio waves and looks like a star.



Tiny TV eye for industrial probes

A TV camera only one and a half inches in diameter has been developed by British engineers for probing pipelines, fuel tanks, aircraft frames and other structures. The structure being examined does not have to be dismantled. The camera can be attached to cables from 50 to 450 feet long and is said to produce remarkably sharp pictures.

Vitamin E may be good for lungs

Urban dwellers choking on smog and auto exhaust may be able to safeguard their lungs with vitamin E. A Duke University researcher, working with rats, reports that a vitamin-E-rich diet may help neutralize the damaging effects on lungs of pollutants such as ozone and nitrogen oxide. ★★★

New Rubber Stamp Business Pays Beginners UP TO $16.50 an hr.

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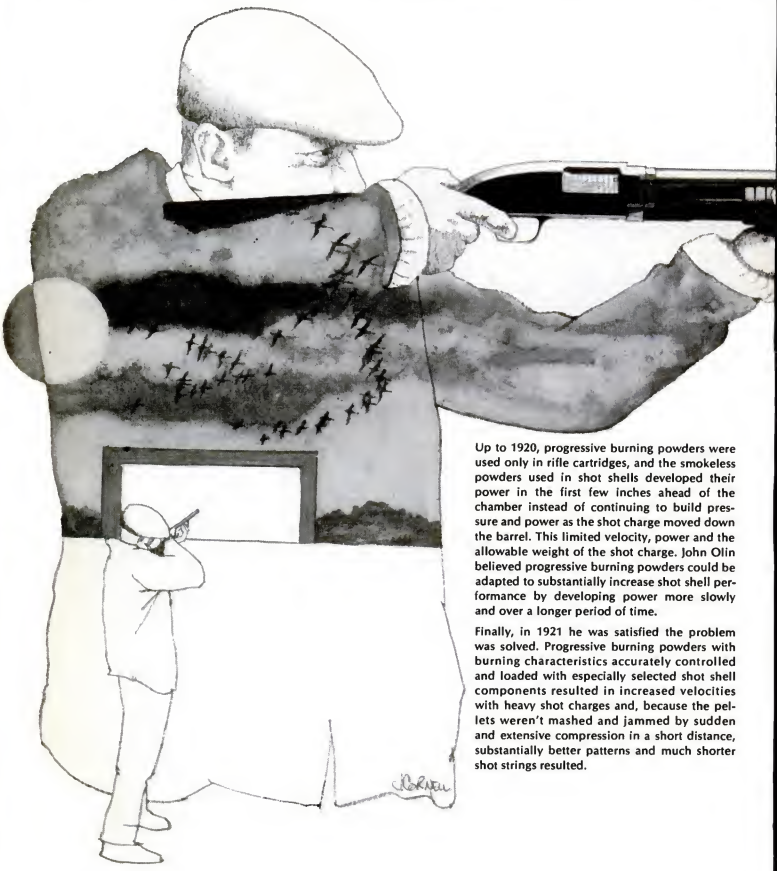
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When John Olin fired the iron fence in 1922, he knew



Up to 1920, progressive burning powders were used only in rifle cartridges, and the smokeless powders used in shot shells developed their power in the first few inches ahead of the chamber instead of continuing to build pressure and power as the shot charge moved down the barrel. This limited velocity, power and the allowable weight of the shot charge. John Olin believed progressive burning powders could be adapted to substantially increase shot shell performance by developing power more slowly and over a longer period of time.

Finally, in 1921 he was satisfied the problem was solved. Progressive burning powders with burning characteristics accurately controlled and loaded with especially selected shot shell components resulted in increased velocities with heavy shot charges and, because the pellets weren't mashed and jammed by sudden and extensive compression in a short distance, substantially better patterns and much shorter shot strings resulted.

first Super-X against an
he had something extra.



But John Olin couldn't resist. Even though all the tests checked out perfectly, he had to make a simple test of his own. He went behind the plant where a long corrugated iron fence stood and fired against it. First, he shot the accepted long range load of the day. Then the new load. The sound of the new load striking the fence told the story. It was the sound of power. All this was later confirmed by sophisticated technical equipment, including a Flightometer invented by F. W. Olin, John Olin's father and founder of the Western Cartridge Company.

Introduced in 1922, the new load was named Super-X for two reasons: first, the super excellence of the results and secondly, because no load information other than shot size was printed on box or shell. This mystery or "X" factor lead to the Super-X name. Super-X gave more velocity with 25% more shot and supported in every way the field test results duck hunters along the Illinois river had enthused over.



Instantly successful, Super-X attracted a horde of imitators and detractors. Some even went so far as to put damaged shotguns in shop windows with signs indicating that Super-X had done the damage. The net result was that more and more shooters wanted "that powerful new long range load". The smear campaign backfired. Hunters knew a good thing when they saw it.

But 1922 is ancient history, and no product stays on top from nostalgia alone. Constant research and restless dissatisfaction that anything is ever as good as it might be have lead to more than fifty years of improvement in shot shell design and performance. They are far too numerous to list all, but a few of the Super-X highlights through the years deserve to be mentioned.

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FIRST Rifled Slug Load
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FIRST (and only) Ball Powder
FIRST 2¾" magnum
FIRST protective (Mark 5) shot collar
FIRST magnum with powdered polyethelyne in shot column (Super-X Double X) for up to 90% patterns
FIRST compression-formed, one piece plastic case, eliminating base wads

Todays Super-X is the culmination of 51 years of long range shot shell innovation and brings to wild fowlers all of the desirable features developed over that time. Super-X today comes with non-corrosive priming, Ball Powder for cool, clean burning, an over-powder cup wad to keep hot gas out of the shot column, cushion filler wads to soften ignition shock, and hard round shot protected against deformation against the barrel by the Mark 5 collar. All packed into a tough one-piece, compression-formed, plastic case that shrugs off weather. Look for Super-X in either Western or Winchester brand — you've got history and performance on your side when you do.





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BY ROBERT LUND

DETROIT LISTENING POST

Junior Cadillac for '75

Cadillac's long-promised junior car will be out next year. Positively. No evasions, no contingencies. The crew assigned to the car is working around the clock, seven days a week. GM hasn't fixed a date for production, but Cadillac is under orders to get rolling no later than the beginning of the '75 model run, before that if possible. If Cadillac can make it, the car will be a half-year model, with the first showing of the first pilot job at the Chicago Auto Show in late February or early March. Cadillac has never had a half-yearer before, but GM wants its Mercedes fighter to be unleashed as soon as it's ready, and never mind waiting for new-model time.

Half-pinter for AMC

American Motors is between the fat and the fire on talking or not talking about the ultimate mini it has coming a year from now. The company has put a tight security wrap on the car but would like to spike some of the rumors. One story making the rounds is that the car will be a glamorized golf cart. That's bunk, according to a debunker inside the company. Basis for the golf cart description is the fact the car will have a wheelbase just over 90 inches. The miniest mini yet has also been confused with a modified Gremlin a Michigan company is developing to run on batteries. The only for-sure information on the car is that it will have a single seat, accommodate two people and measure 150 to 160 inches in overall length. But AMC insists it will be a real car, not a motorized grocery cart nor a chopped-down version of anything AMC has now.

Scramble for GM Wankel

There's a hot argument waxing inside GM over which division or car should get second crack—after Vega—at GM's Wankel engine. The hair-pulling is between Pontiac, Buick and Olds. Cadillac takes an indifferent position on the rotary, isn't particularly concerned one way or the other. GM's working up a list of possible applications for the engine—automotive and nonautomotive—and it could turn out that none of the car divisions will get second dibs on the Wankel. GM's developing a mini motor home, to be produced either by Chevrolet or Truck & Coach Div. As of right now, the division that produces the mini home is the favorite to get the Wankel after Vega.

The company apparently feels its rotary engine has been developed to a point where engineers who were working on it can be reassigned to other projects. For instance? Studying larger versions of the Honda stratified-charge engine, for one, and evaluating a car-size—as opposed to a truck-size—turbine for another.

Chrysler pushing turbine

Chrysler has made, or believes it's about to make, an important breakthrough on the turbine. Question is in what area. Cost of producing the engine? Materials? Performance versus a conventional piston engine? Pollution control? Chrysler isn't talking, yet. The company may be holding off on this disclosure in order to use it as a zinger intended to counter GM's Wankel coming next year.

New approach on lights

Some low-price cars may go to small (1.5 and 9-volt) batteries for lights other than headlights as a means of simplifying electrical wiring and reducing the drain on the car battery. Electrical engineers say mini throwaway batteries could be used to power lights in such areas as the engine compartment, trunk, glove box and dome lamp. In

(Please turn to page 38)



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DETROIT LISTENING POST

(Continued from page 36)

addition to conserving the car battery for other accessories, this approach would save on production costs and let car owners handle their own services.

Too much mini?

Are automakers overdoing it in trying to miniaturize components? Supplier sources working on down-the-pike parts say some electronic items will be so mini-size it will be impossible for mechanics to adjust or repair them. Parts will have to be pitched out or returned to the factory for rebuilding and replaced with a new piece. This may be a boon for the parts companies, but it puts Detroit in sharp conflict with the conservation movement.

Sleek Jeep

American Motors' ace stylist, Dick Teague, who manages to get a dollar's worth of new look for every quarter that he spends, has been given a don't-spare-the-whipped-cream bankroll to high-style AMC's Jeep. Be a couple years before you'll see the results.

Dummy lights overdone?

The government has ordered the auto companies to install a light-combined-with buzzer on the dashboard of all '75 cars to alert the car owner if the pollution control system fails or malfunctions. (But there's nothing in the law requiring the car owner to have the gear repaired if it conks out.) Detroit has no choice but to go along with the law. But carmakers aren't happy about adding a dummy light each time the government mandates a new piece of equipment.

Charlie Heinen, executive engineer for Chrysler, makes an interesting point on this. The more complicated the car, Heinen points out, the more chances there are for something to go wrong. And dummy lights can go wrong, just like anything else. So do you add a backup dummy light to tell you if the primary dummy light is working? Heinen and his counterparts at the other companies hope not. ★★★



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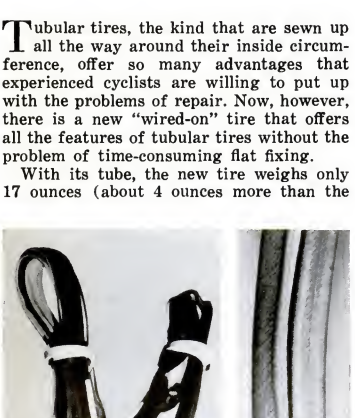
THE BICYCLE SHOP

BY EUGENE A. SLOANE

Newly introduced ultralight 'wired-on' tires offer all the advantages of tubular sew-ups without their repair problems. But installation is tricky. Here's how.

Tubular tires, the kind that are sewn up all the way around their inside circumference, offer so many advantages that experienced cyclists are willing to put up with the problems of repair. Now, however, there is a new "wired-on" tire that offers all the features of tubular tires without the problem of time-consuming flat fixing.

With its tube, the new tire weighs only 17 ounces (about 4 ounces more than the kind of tubular tire you'd use for touring). By comparision, conventional "wired-on" tires with tubes weigh 24 ounces (about 41 percent more than the new superlight). On the other hand, the new tire costs upward of $13 with tube while the conventional 27 x 1¼-inch tire costs about $8 with tube.



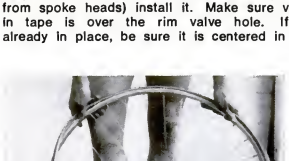
New Corsa Strada lightweight tire (left) is shown alongside a conventional tubular tire; both are folded for use as spare tires. The photo at right shows the wire (bead) on both sides of the new tire's opening.

Tubular tires, which are 27 x 1⅛ inches versus 27 x 1¼ inches for conventional tires, offer less rolling resistance and can be used with lighter rims, so they are easier to pedal. However, they're more prone to flats. The new lightweight wired-on clinchers are the same size as tubulars, so are much easier to pedal than ordinary clinchers. For enthusiasts who want the advantages of tubulars with the convenience of clinchers, the lightweights are the answer.

The new lightweights are made exactly like tubulars, with the addition of a wire bead—but since they are not shaped like a conventional tire, great care must be taken in installing them. If they aren't mounted on the rim exactly right, they will blow out at the 90-pound pressure you must inflate them to.

The new tires are called Corsa Strada and are distributed by Raleigh. They are handmade in Italy, and may be in short supply at this time. Remember: You *must* use a 27 x 1⅛-inch tube with them.

Step 1: If rim tape is not installed (to protect tube from spoke heads) install it. Make sure valve hole in tape is over the rim valve hole. If tape is already in place, be sure it is centered in rim well.



Step 2: Put one side of the tire over rim edge, so bead of tire is in place all around the rim. Make sure only *one* side of the tire is in place. The other side must be off the rim so the tube can be installed.

Step 3: Install the tube valve in rim-tape and rim-valve holes. You will probably have to lift rim tape up off the rim to get the rubber-covered valve of the tube through it. Then install the tube all the way around inside the tire, working from the opposite side of the tire you installed in Step 2. Note

(Please turn to page 42)

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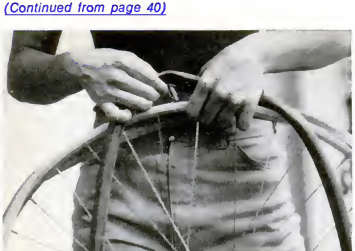
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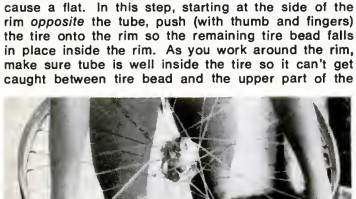
MEADVILLE, PA. 16335

(Continued from page 40)



in the photo above that one edge of the tire is outside the rim; this is the proper position for inserting the tube in this step. You will note that there appear to be two inches extra of tube circumference; this is normal. As you insert the tube, spread the extra length around inside the tire.

Step 4: Before we go into this step, remember that you should not use *any* tire irons or other tools to install these superlight tires. If you do use tools, chances are excellent you will pinch the tube and cause a flat. In this step, starting at the side of the rim *opposite* the tube, push (with thumb and fingers) the tire onto the rim so the remaining tire bead falls in place inside the rim. As you work around the rim, make sure tube is well inside the tire so it can't get caught between tire bead and the upper part of the



rim brake flat (which will keep tire from seating into rim and cause a blowout). To make it easy for the tube to spread about inside the tire as you inflate it, it's a good idea to spread some talcum powder inside the tire before you mount it on the rim.

Step 5: Inflate the tire to about five pounds, and (with fingers) make sure the tire bead is well seated inside the rolled inside section of the rim. (Contact between tire wire bead and rolled or formed section of the rim is what keeps the wired-on tire from coming off the rim.) Make sure the tire is also on evenly; the same amount of tire casing should show on both sides of the tire. Inflate to 20 pounds or so and check tire seating again. Repeat at 40



pounds. Once you are sure tire, *especially* at valve, is well seated and bead is holding it in rim, inflate to normal for this tire—90 pounds per square inch.

The new Corsa Strada wired-ons look so much like tubulars that you will have a lot of fun fooling your friends who won't believe you are not riding tubulars. And you won't have to carry two or three spare tubulars on trips; all you'll need will be, perhaps, one tire casing and one or two extra tubes and a patch kit. Weight is less than the complete tubulars you carried before.

If the Corsa Strada seems like too much trouble, a compromise between a heavy wired-on and the new tubular-type wired-on would be the Japanese light gumwall 27 x 1⅛-inch tire which weighs only 18½ ounces and costs around $9 with tube. These tires are a bit trickier to mount than conventional wired-ons, but easier to mount than the Corsa Strada. I prefer the Corsa Strada because they ride just like tubulars; in fact, they *are* tubulars except for the wire bead and non-sewn-up construction.

If this point hasn't been made clear, you should remember that the new Corsa Strada lightweights and the new Japanese lightweight wired-on tires fit on the *same rims* as your conventional 27 x 1¼-inch wired-on tires. But both the lighter tires *must* be used *only* with the new 27 x 1⅛-inch tubes. (You can use a 27 x 1¼-inch tube in an emergency, inflated to about 60 p.s.i., but when you feel the tire thumping, stop and let some air out to avoid a blowout.)

You can't use the new Corsa Strada or new Japanese wired-ons with tubular rims; and, of course, you can't use tubulars on wired-on tire rims except in dire emergency. Tubulars will stay on wired-on rims long enough to get home, but wired-ons won't stay on tubular rims because they have no bead-seating well.

(Please turn to page 44)



1933

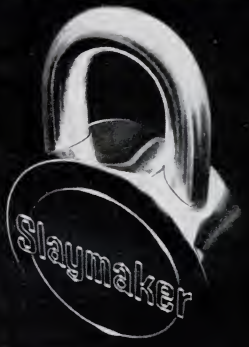


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THE BICYCLE SHOP

(Continued from page 42)



Leg power or battery—take your choice

An electric bicycle that gives you the option of pedaling or purring along on battery power is one answer to the gasoline shortage. It's ideal for an older rider who needs some mechanical assistance. The new Solo Electric goes about 16 mph and travels 25 miles between charges from a 24-volt charger (available as an option). It fully charges overnight. The cycle is $495 and the charger is $45. The supplier is Solo Motors, Inc., Box 5030, 5100 Chestnut Ave., Newport News, Va. 23605.



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It will add about three extra pounds of weight per tire—but if you're tired of flats, you can fill your tires with TyrFil and they'll be impervious to punctures. We can't recommend the material for tourists (who wants to carry around six extra pounds?) but it would be fine for a child's bike or for an industrial bicycle. You need special tools to install the stuff, and a filled tire costs around $10. The maker is Synair, 14191 Livingston St., Tustin, Calif. 92680.—E.A.S.

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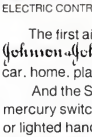
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ALL OUTDOORS

National Hunting & Fishing Day, Saturday, Sept. 22, should offer a particularly appropriate chance for outdoorsmen to tell our conservation story. Boatmen, campers, hikers, swimmers, fishermen, skiers, hunters, snowmobilers, recreational-vehicle owners are on record for many years as the leaders among those who work actively to improve our environment. Recent figures indicate hunters have been paying a large share of the tab: $427 million has been collected for conservation since 1937 from the federal excise tax on sporting arms and ammunition. Game management and protection of nonhunted and endangered species are among supported activities. The new National Hunting & Fishing Day is a chance to show what the appeals of the outdoors are all about.

As the summer has shown, careful camping doesn't require a lot of gasoline or other energy in short supply. Recreational Vehicle Institute figures indicate the average outdoorsman doesn't travel more than about 300 miles from home, and the Family Camping Federation notes the vacationing family's car and completely self-contained rig uses only one-third of the energy consumed at home.

Our field tests of equipment continue to locate items particularly suitable and durable for outdoor use. Tried any of the new air rifles recently? If your last experience was with your first BB gun years ago, better take a look at some of the variable- power high accuracy models now available, like the latest from Daisy, Crosman, Sheridan Blue Streak, Benjamin, Sears and others. Weighted and balanced like conventional guns, they are recommended for beginners and advanced shooters alike.

Campers can now light up the dark with more than a candle or campfire. New fluorescents use much less current. For night fishing or even changing a tire, consider one of the improved headband flashlights.

Two of the most remarkable sports machines we have ever test-driven are Outboard Marine's new rotary outboard engine and Curtis Pitts's world championship Pitts aerobatic biplane which we checked out recently. Each will be given a full report in upcoming issues.

A code of ethics for outdoorsmen, prepared by Warren Page, president of the National Shooting Sports Foundation, was unanimously adopted by the American Outdoorsman Conference at a recent annual convention. The code is designed for hikers, skiers, hunters, fishermen, snowmobilers, boatmen, campers and all the others that make up the continent's nearly 100 million outdoorsmen.

For nearly 25 years, Page was shooting editor of *Field & Stream magazine*, and now 50 of his stories about hunting, outdoor adventure, game rifles and conservation have been brought together in a distinguished new volume, *One Man's Wilderness*, $8.95 from Holt, Rinehart and Winston.

Activities calendar: Sept. 4-8, International Tuna Cup Match, Wedgeport, N.S.; 9, National Industrial Trap Championships, Middletown Sportsman Club, Middletown, Ohio; 14-16, North American Sail & Power Show, Cedar Point Marina, Sandusky, Ohio; 14-16, NRA Canadian American International Skeet and Clay Pigeon Championships, Malone Skeet and Trap Club, Malone, N.Y.; 19, Family Camping Federation symposium, *Camping and the Energy Issue—'74 and Beyond*, O'Hare Inn, Chicago, Ill.; 22, NATIONAL HUNTING & FISHING DAY, nationwide; 26-28, All American Bass Tournament, Watts Bar Lake, Tenn.; 27-30, Newport International Sailboat Show, Goat Island Marina, Newport, R.I.; 27-30, North Atlantic Boat Show, Yacht Haven West Marina, Stamford, Conn.; 29-30, International Benchrest Tournament and Hunter Rifle International Championship, Central Pennsylvania Rifle Club, Dauphin, Pa.

(Please turn to page 50)

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(Continued from page 48)



New water power from a motorcycle maker is Honda's four-stroke B-75 K1 outboard with 7.5 hp, overhead cam, and reportedly quiet operation using only ¾ gal. per hour at full throttle. No fuel/oil mix needed.



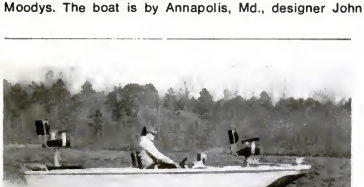
Keeping tools handy should be easy with Tempo Tool Bag slipped through handle of 6-gal. portable tank to provide storage on each side. Made of gas and oil-resistant vinyl. $4.50, Tempo Products, Cleveland.



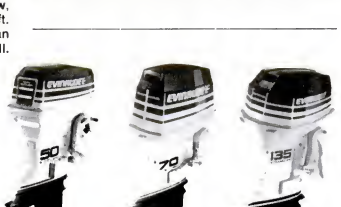
Latest look in offshore racers, seen at the Tokyo boat show, is long and lean. Yamaha X-100 is 33 ft. long with a 4.5-ft. chine beam and is powered with twin 351-cu.-in. Holman Moodys. The boat is by Annapolis, Md., designer John Gill.



Narrow Yamaha X-100 requires tandem engine placement, "Coaxial Drive" prop arrangement engineered by Gill. Minimal torque, high speed, easy motion in big seas are reported from tests.



Bass boats are getting bigger. Apollo, from Triple C Enterprises, Cabot, Ark., is 18-footer mounting Hardin Marine engine with water-jet power from 12YJ Jacuzzi Jet and reported thin-water speeds to 55 mph.



Newest from Evinrude are '74 Sport Line models: 50-hp Sizzler, Hustler 70 and Strangler 135. Custom red, white, blue styling is featured, plus stainless-steel props. Also new in line: 9.9 and 15-hp models.

(Please turn to page 52)

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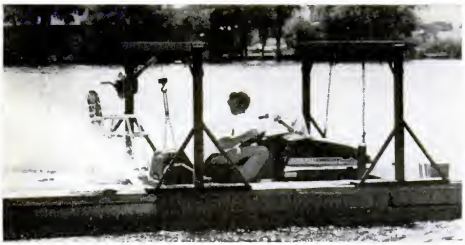
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(Continued from page 50)



Head start on snow season begins afloat on Fox River, Oshkosh, Wis., at Mercury Marine test base where suspended snowmobiles throw wet rooster tail. Track turning in water has resistance to stop over-revving while cooling, lubricating. Three Trail Boss Mercs are offered for '74.



Choke-Matic claims double-barrel versatility for single-barrel pump or auto shotguns. After first shot choke closes. $35. Triple-S Development Co.



Blunderbuss fanciers who have wondered where their next model was coming from can get this Queen Anne period flintlock muzzle loader by Navy Arms Co., 689 Bergen Blvd., Ridgefield, N.J. 07657, for $100.



Multipurpose cartop carrier, the Hema Exclusive rack, telescopes to fit any size car, folds into trunk, adapts for luggage, skis, fishing rods, canoes. Model is $40 from ICM Marine Products, North Vancouver, B.C.



Make your trailer into a fifth-wheeler with new adapter kit from Land N' Sea Craft, San Jose, Calif. Designed for their Trail-A-Cruiser amphibious RV, fifth-wheel bracket unit can be bolted to almost any trailer tongue. $485 with hitch included.



Glass-to-glass "Taper Lok" ferrule of new Daiwa 8300 Super Power two-piece rods can provide light continuous one-piece action, strength in wide selection of sizes.

BY BILL HARTFORD

MPORTS AND MOTORSPORTS

low to run a rally

Running rallies is a tough test for tires. There's no better approach to research and development of family car tires than running them on a rally car— and that's exactly what Pirelli does with its tires. Among the



many rally-winning cars running on Pirellis is the Fiat 124S shown here. "Rally-developed" last year in international rallying are three new radial tires now available here: the Cinturatos CN54/70, CN36/70 and IS35.

The sport of rallying is a fascinating one and we like what Pirelli president Giorgio della Seta says about rallying and the young driver: "It's tempting for young drivers to show off their driving prowess through speed rather than skill . . . the rally can channel enthusiasm so the car will be treated as a *precision* instrument rather than an instrument for raw speed." You can learn more from the company's *Let's Go on a Rally* booklet. It's 50 cents (25 cents on orders of 10 or more). Write to Rally Booklet, Pirelli Performance Bureau, 600 Third Ave., New York, N.Y. 10016.

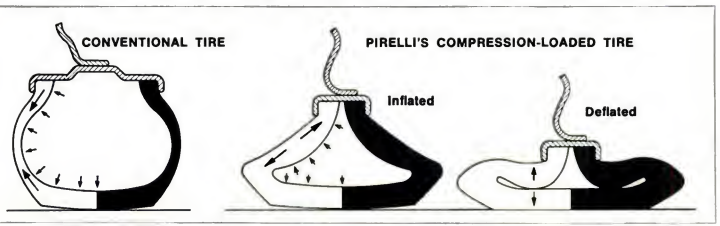
What she's burning is rubber

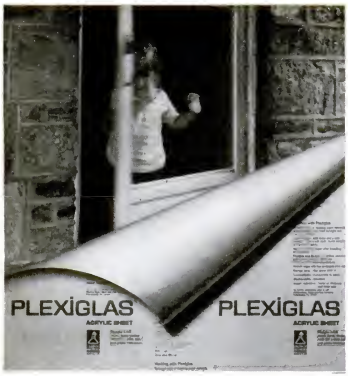


"Cha-cha" Muldowney's real name is Shirley. That should be the clue that this driver isn't one of the boys. She's the first woman racer to earn an NHRA AA fuel dragster competition license, and she knows how to use it! She turned a 6.61 E.T. at 211.0 mph recently. For relaxation she runs a Plymouth Satellite Sebring Funny Car on the NHRA circuit.

(Please turn to page 58)

New concept in tires recently announced by Pirelli involves design change where sidewalls operate under compression rather than under tension as with conventional tire. Advantages include cool running, simpler construction, safety in event of blowout (wheel supported on rubber which won't come off rim).





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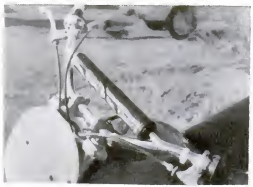
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IMPORTS AND MOTORSPORTS

(Continued from page 57)

Something new for rough riders

Every motorcycle rider should know the value of protective gear—without learning the hard way. It's natural to find your limits by pushing a little farther each time. And you can be sure that the time will come when you're saddled up for dirt and riding the pegs that you'll lose it. It's nice when this doesn't result in a "handlebar smile." One way to protect against broken teeth is with this crossbrace tooth guard—a 1½-inch



foam blanket wrapped in naugahyde. Get it from Webco dealers for $2.95 (Webco Inc., 218 Main St. Venice, Calif. 90293).

Speaking of rough riders, the world's best took Carlsbad, Calif., by storm at the Hang Ten United States Motocross Grand Prix, first such World Championship event to be held in this country. We missed it, but marked July 14, '74 for next season's Hang Ten. The turnout of fans and the TV ratings indicate that motocross is red-hot and growing—for spectators and participants. Top participant is Roger de Coster of Belgium riding a Suzuki. If he keeps his lead, he'll take the '73 Championship. He carries the big banner for Suzuki, but others are hanging ten for the team, too. Picture is of Rich Thorwaldson crossing finish to grab the 250-cc Motocross and overall title at Pro Pacific AMA Motocross in Northern California. ★★★



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Marble	X	X	X	
Flagstone	X	X		
Brick	X	X		
Glass	X	X		
Fiberglass	X	X	X	X
Tempered Hardboard			X	X
Asbestos Cement	X	X	X	X
Composition Board			X	X
Synthetic Marble	X	X	X	X
Plywood			X	X
Plaster			X	X
Counter Top Material	X	X	X	X
Hardwood Flooring			X	X
Stranded Cable	X	X		
Spring Steel	X	X		
Hardened Chain	X	X		
Stainless Steel	X	X	X*	
Tailpipe Bolts	X	X		
Cast Iron	X	X		

*requires coolant and variable speed machine.

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PHOTO HINTS

FROM READERS







Picture frame makes an inexpensive photo proofer

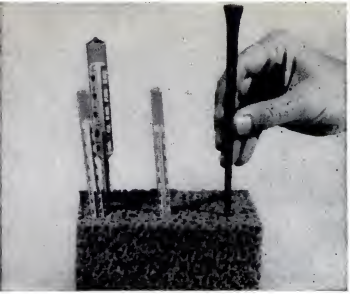
The quickest, easiest way to evaluate your shooting is by contact-printing a proof sheet for each roll you shoot. But commercial proofing easels cost $10 or more, and the cheapest, simplest alternative—a sheet of plate glass—is likely to collect fingerprints, or slip out of your hands and shatter on the floor.

But you can build your own proofer for under $3. Materials are just a 9x12 picture frame with glass, a piece of ½-inch plywood cut to the frame's outside dimensions, a 12-inch square of indoor-outdoor carpet, plus hinges and tack bumpers.

To start, remove the small nails or wires which hold the glass in the frame and take out the glass. Then line the frame's inside rim with glue, replace the glass and weight it with a heavy book till dry.

While that's drying, paint the bottom and edges of the plywood (but not the top), and put a tack bumper on each corner of the bottom. When the paint dries, place the frame on the base and secure the hinges. Then glue the carpet square—face down and foam backing up—to the plywood base. Trim away the excess. A bulletin-board pushpin in the frame side opposite the hinge makes a good lifting handle.

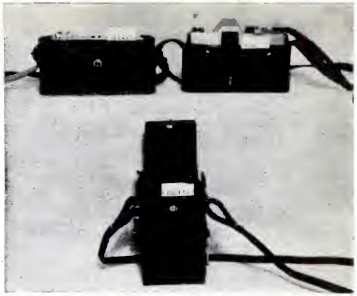
—Kenn Oberrecht, Fairbanks, Alaska.



Sponge holds darkroom thermometers

Need a safe, convenient place to hold your darkroom thermometers? Cut holes in a large plastic sponge, using a sharpened piece of quarter-inch copper tubing as a cutter. The holes in the low-cost "rack" will hold the thermometers and stirring rods conveniently—and you can still use the sponge for wiping up darkroom spills.

—Ken Patterson, Regina, Sask.



Data sheet makes handy film reminder

You won't forget what's in your camera if you fold the film's data sheet and tuck it into your camera case with the film's name showing. What's more, that leaves the data sheet right there when you want it for checking exposure, filter factors or anything else you may suddenly want to know about before you push the button.

—V. P. Kisner, Harvey, Ill.



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Minolta SR-T 101/Minolta SR-T 102

APPLIANCE CLINIC

BY PAUL MANN

Coy coil

I have a 10-year-old Hamilton gas clothes dryer that has pooped out. The appliance switches on, and the drum revolves okay, but the burner doesn't go on. What's wrong?—Roy Granelli, Los Angeles.

Sounds as though the igniter coil has gone bad. It has just one function: to light the gas pilot light, which in turn lights the main burner. If this coil has burned out, there will be no ignition.

Pull the wall plug, shut off the main gas valve, and remove the front or the top of the unit (depending on the model you own). The burner has to come out since the coil is attached to it. Disconnect the old coil and install a new one.

You'll be interested to learn that *PM* has planned a Clip-and-Save Know-How feature on troubleshooting clothes dryers. Watch for it in an upcoming issue.

Unagitated agitator

I have a Maytag automatic clothes washer (Model 142B), which is about 13 years old. It is kept in the basement where the temperature never goes below 60° F. During the wash cycle the agitator moves very, very slowly. I suspect that the grease in the drive gears has congealed, but an appliance man has told me that the machine is just too old to work properly and that I should buy a new one—from him, of course. What do you think?—Albert Dalton, Waterbury, Conn.

The problem may be the drive belt's self-adjusting mechanism. The agitator is driven by a belt that is driven by the motor. The belt is adjusted by a spring-loaded mechanism—springs pull the motor back to tighten the belt as the agitator kicks in. The motor rides back on four nylon rollers, and experience has shown that these rollers are probably causing the problem. After years of use, one or more of the rollers can break, which means that the motor won't slide back to the position required for full belt adjustment on agitation. You can check on this by removing the front panel from the machine, revealing the motor. Lift the motor up and down on its mount. If there is sloppiness, rollers should be replaced.

Considering the washer's age, this would be a good opportunity to replace springs as well. You can probably do the job yourself by taking the motor out of the machine and taking apart the slide assembly. Rollers can be ordered by using part No. 2-11952. Springs are part No. 2-2718. Total cost of parts is about $2. They can be ordered from the Maytag Co., 2232 Route 22, Union, N.J. 07083.

One more thing: The belts in these machines must not be adjusted too tightly. To adjust the agitator belt, pull the motor back all the way against its slide and see to it that there is $\frac{3}{8}$-in. play at the belt's midpoint.

Attack from the rear

Our Frigidaire refrigerator-freezer developed a loud whine from the small fan motor that circulates air from the freezer compartment to the refrigerator section. An authorized serviceman replaced the motor for $38.20—$17 for the part and the rest for labor. The high cost of labor results from the fact that the motor is located behind the freezer compartment, requiring much dismantling so you can reach it. Could I cut an access door in the rear of the appliance that would permit easy removal of the motor should it fail again?—John J. Steinke, Lakeland, Fla.

Your proposed access hole wouldn't do you a bit of good, since the motor mounts from the front. You still would not be able to remove the motor from the rear if it failed again. Besides, motor failure such as this isn't a common problem, as motors are

(Please turn to page 64)

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(Continued from page 62)

equipped with highly reliable double bearings. I'd pass this experience off as a fluke.

Slow mix

My General Electric mixer doesn't work properly. In LOW *position, it makes noise but won't revolve. In* MEDIUM, *it makes noise and revolves as if it were binding. What do you think is wrong?—Paul Dembry, Grosse Pointe, Mich.*

I think you have a gear problem. Gears probably aren't meshing properly, perhaps because of stripped teeth. A GE small-appliance center in my area quotes a carry-in charge of $5.90 to replace them. If you want to tackle the job yourself, cost will be about $1.55 for each of two gears.

Disassemble the appliance to reveal the gears, seated beneath the bottom plate, and inspect for damage. After new gears are in place, lubricate them with gear lubricant or petroleum jelly.

Switch off

Here's an odd one for you, Paul, concerning a Westinghouse food waste disposer. It will work for a bit after it is first started, and then cut off. If I wait a few minutes and push the reset button, the unit then operates properly for the remainder of the cycle. What's wrong?—Richard T. Carey, New Carrollton, N.C.

It's easier to say what isn't wrong. What isn't wrong is the motor and the wiring—or you wouldn't be able to restart the disposer and make it work for its entire cycle by pushing the reset. A weak reset switch is a likely possibility. The surge of current when the unit is started may be causing a weakened bimetal to flex and cut off the motor. A new switch will cost between $11 and $15, depending on which disposer model you have. ★★★

If you have a question about any appliance, send it to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Sorry, but letters cannot be answered individually. Problems of wide interest will be answered in this column.

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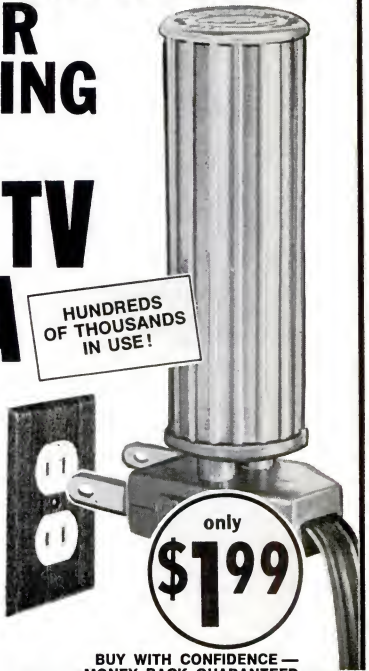
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There's lots of visibility for driver through all that glass. The luggage pod (on top at rear) is an option.

Driver's report: Cortez motor home

PM driver proves what owners say: This 21-foot, front-wheel-drive vehicle handles like a car.

by John Linkletter
MANAGING EDITOR

"It drives better than a car," wrote one owner, a New York manufacturer. That might seem an overly enthusiastic reaction to herding around an 8500-pound Cortez Touring Home that's 21 feet 4 inches long. But in my own test driving, I found the Cortez is also more fun to drive than a car—I got more kick out of driving than I had in years.

Each owner I queried had something good to say about the way the front-wheel-drive Cortez handles. A good part of their joy comes from its 455-cu.-in. Olds Toronado engine; there's always a nimble response to the accelerator, even on a hill. Another factor is the ride; a four-wheel independent suspension system carries you along in a remarkably luxurious fashion. The power steering, combined with power brakes that stop the vehicle with no nonsense, gives a driver the feeling of complete control. And it's quiet. The driver and front-seat passenger can converse normally while traveling at highway speeds.

Little wonder owners like to drive it!

Because of its front-wheel drive, the Cortez doesn't have the usual drivetrain running its full length. Consequently, it has a low profile for a motor home; the roofline is only eight feet above the road—and you

(Please turn to page 66B)

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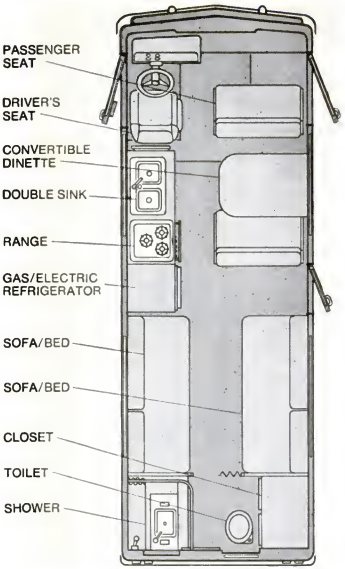
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really don't need the doorstep to mount through the side door. The low-to-the ground construction has one other payoff: You don't have that top-heavy feeling you find in some motor homes.

On the other hand, there is a hump over the front-drive setup that's a bit of an obstacle when you climb to either of the front seats from the rear. (With two-door access to the front seats, however, you don't have to make that climb very often.)

The Cortez has a fairly standard interior layout. It sleeps four, two on single sofa/beds at the rear and two on the convertible dinette. Of course, it has the amenities you'd expect: three-burner stove with oven, sink, seven-gallon water heater, six-foot 12-volt/110-volt electric refrigerator, shower, 38.5-gallon holding tank, wood paneling, wool carpeting, 38.5-gallon water tank with demand pump and a 22,000-B.T.U. ducted forced-air heater. Then there are such nice touches as, for example, 11 individually controlled lights and five dome overheads, plus five electrical outlets.

Other luxuries that come as standard equipment are a 36,000-B.T.U. automotive airconditioner, six-way power seat, cruise control, Thermasan waste-disposal system, trailer hitch and water purifier.

One of the niftiest features for the driver

(Please turn to page 66D)





Passenger seat, which faces forward while you travel, flips over to become dinette seat (in foreground of left-hand photo). Above: Driver's six-way power seat faces tilting steering wheel and the well-arranged instrument and control-knob display of dashboard.

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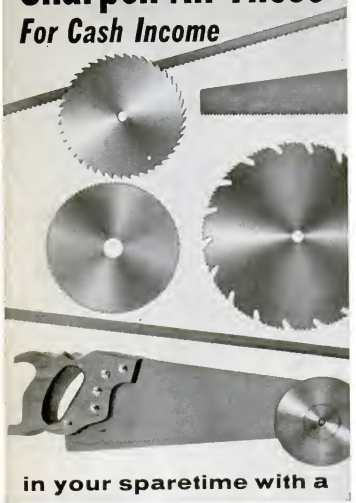
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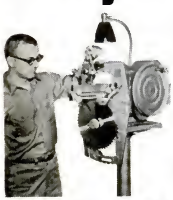
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CORTEZ MOTOR HOME

(Continued from page 66B)

is the lighted label just above each knob on the dashboard. If, between trips, you tend to forget which switch is which, the label locates it again for you at a glance. After I picked up the test motor home at Kevah Konner agency in Pine Brook, N.J., I set out in an unfamiliar vehicle on a crowded, strange highway in the evening during a rainstorm. Unable to spare more than a half second glance away from the road, I found myself blessing the guy who put those lighted labels in place so I could instantly find the right knobs.

Among the options (which can run the Cortez base price of $22,250 as high as $25,000) are a generator (three choices available), a 13,000-B.T.U. roof-mounted airconditioner, a fiberglass rooftop luggage pod, stereo radio and a smoke and gas-fume detector.

The construction of the Cortez drew favorable mention from owners. The company describes it as "welded steel unitized construction." A New Jersey research engineer likes the resultant "solid feel," and an executive likes the "inherent safety."

I found that I got 7.9 miles per gallon. Owners, who had driven anywhere from 3500 to 8500 miles, reported they were getting 7 to 10.5 mpg.

Troubles are minor, contend the owners. One, a New Jersey executive who has previously owned a Cortez, said: As with a boat, "the shakedown cruise is a longer process than assembly-line inspection. With such a complex piece of equipment, you are bound to develop certain problems.

"On the whole, the Cortez has been very good. The overall quality in the most recent one, I would have to say, is somewhat marred by sloppy workmanship which was not apparent in the earlier version. The troubles which have developed, however, are mostly nit-picking, annoying problems which better workmanship would have overcome."

He concludes: "When I consider I am driving my family many thousands of miles in our motor home, I think it is very important to recognize that in a Cortez this is done with a great feeling of security, and in a very luxurious fashion."

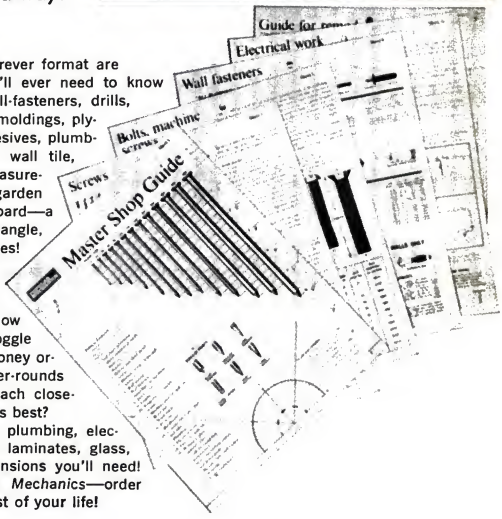
Further information about options, color choices and the like is available from the maker, the Cortez Corp., 777 Stow St., Kent, Ohio 44240. ★★★

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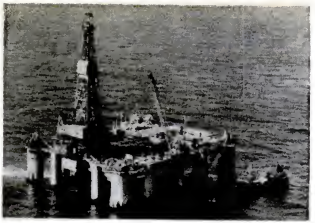
'74 Cars: 20 pages of buying information

Another record year for car sales may be ahead, with waiting lists for certain gas-saving compacts. PM's 20-page car section will make you a smarter buyer.

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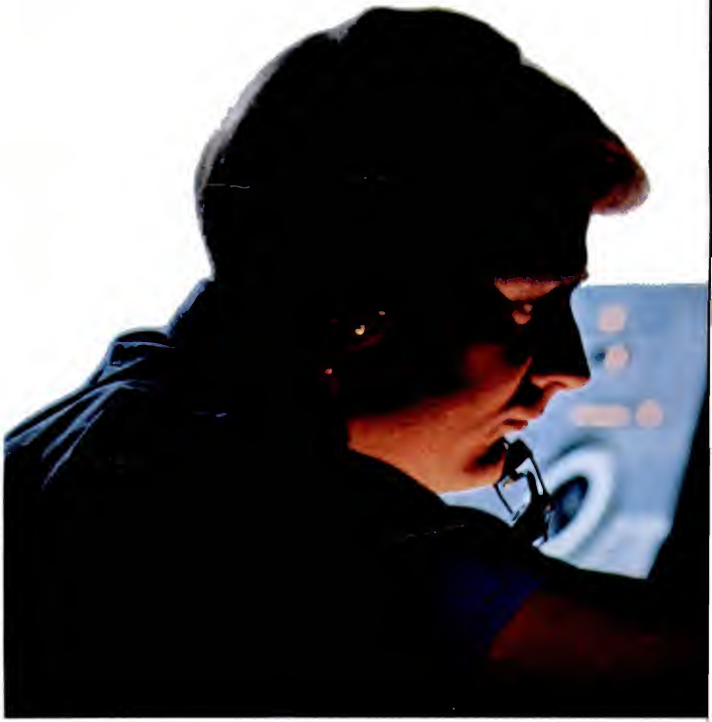
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A place to do your paperwork at home

Your choice of three novel, PM-designed desks that serve as mini offices.



1. THE WALL-HUGGER

Folded, it takes only a foot of floor space.

There are few families that don't need some little nook or corner for doing paperwork—a place for Dad to tackle the monthly bills and plan new projects, a kitchen organizer for Mom, a homework and hobby center for the kids. On these pages, PM presents three original ideas for home desks that are more than just desks. They range from simple to elegant, from small to spacious. Each offers a maximum of work and storage facilities in a minimum of space. Each is, in effect, a mini office in itself.

We call the three the "Wall-Hugger," the "Swing-Wing" and the "Split-Level." Each is designed to solve a particular problem or suit a special need. If you never thought you had space



PHOTOS BY ROBERT D. BORST

Foldaway work center hangs on adjustable wall brackets, is easily located at any desired height. In raised position (top), hinged desk provides roomy 36x39-in. surface—wide enough for two to work at together from opposite sides. When not in use, leg folds up and top swings down against wall, out of way (bottom).

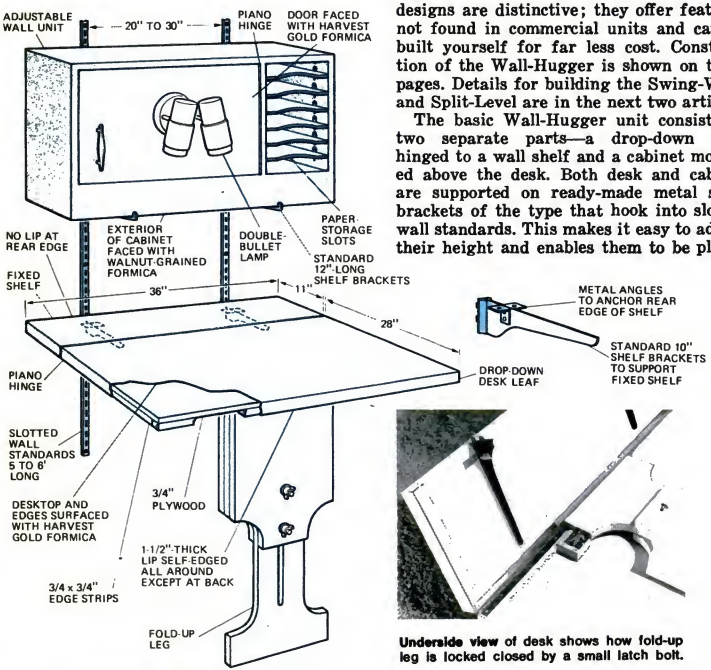


Adding a bulletin board gives you place for messages, postcards, shopping lists. This one is made of cork squares, has space at left for clock and wall phone

for such a unit, consider the possibilities shown here. Two of the three, the Wall-Hugger and Swing-Wing, take little floor space and fold away when not in use. The Wall-Hugger hangs on adjustable shelf brackets and features a drop-down desktop that stores neatly out of the way against the wall. The Swing-Wing sports two hinged extensions that open out to a 7-ft. width, revealing a desk, two-drawer file cabinet, retractable typewriter table and drawers for supplies. With the wings closed, it becomes a handsome, compact chest.

The Split-Level is a more elaborate classic design with rich, massive looks that would be the envy of many a company executive. It has a large main work surface at standard desk height, plus an L-shaped secretary return at a lower level for typing. While it requires more space than the other two units, it adds elegance as well as usefulness to a den or family room. All three designs are distinctive; they offer features not found in commercial units and can be built yourself for far less cost. Construction of the Wall-Hugger is shown on these pages. Details for building the Swing-Wing and Split-Level are in the next two articles.

The basic Wall-Hugger unit consists of two separate parts—a drop-down desk hinged to a wall shelf and a cabinet mounted above the desk. Both desk and cabinet are supported on ready-made metal shelf brackets of the type that hook into slotted wall standards. This makes it easy to adjust their height and enables them to be placed



Underside view of desk shows how fold-up leg is locked closed by a small latch bolt.

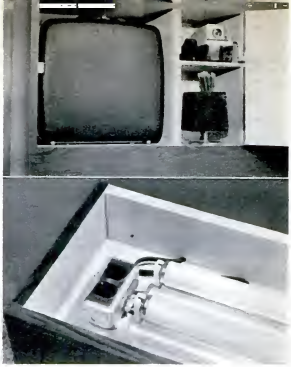
virtually anywhere—in a kitchen as a menu-planning center, in a master bedroom as a hideaway home office or in a youngster's room for study and hobby activities.

In its raised position, the desk forms a spacious 36x39-in. work area—that's large enough for two persons to share from opposite sides. The cabinet above has open paper-storage slots at one end and space behind a door for a typewriter and other supplies. A double-bullet pinup lamp on the face of the door illuminates the desk, and a fluorescent fixture hidden in a recess under the cabinet provides additional down lighting to bath the wall dramatically below it.

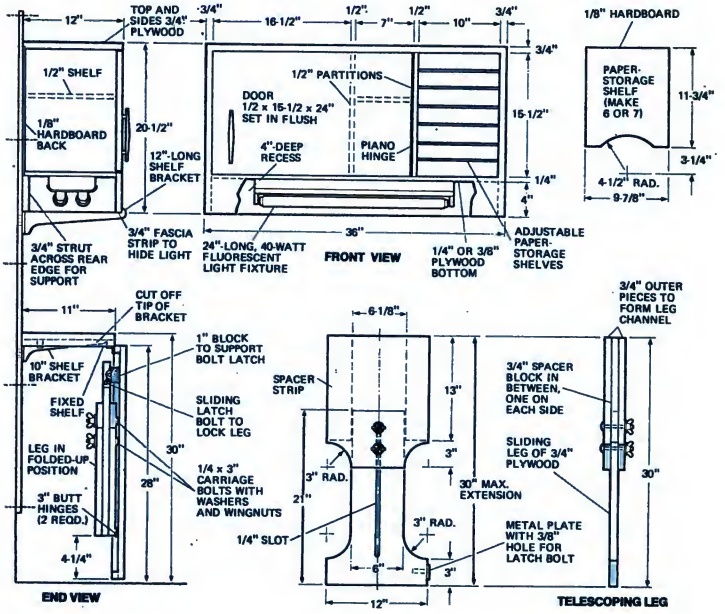
The flexible wall-track system makes possible a number of variations on the basic arrangement. A bulletin board, as shown on the facing page, offers an attractive and useful accessory and can be attached to the wall standards with clips made from

(Please turn to page 178)

PETER TROJAN



Wall cabinet stores typewriter, other supplies (top photo). Lower photo shows recess in underside of cabinet for a fluorescent light controlled by main switch in outlet box.



In-a-chest home office opens wide for business

Remember the old rolltop desk—how you could pull down the front and walk away without disturbing your work? You can do the same almost with this modern version which has wraparound wings that close like the twin doors on a refrigerator.

Posing as a king-size chest when closed, the desk features a swing-out shelf that provides a regulation-height typing stand. Two paper-storage compartments in the wings are within easy reach of your chair. A shallow under-the-desk drawer keeps pens, pencils, clips and the like extra



When wings are swung shut, office fits in a 29x43x48-in. chest. Swung open wide, wings provide spacious work center measuring a whopping 7½ ft.



Wings wrap around file cabinet on one side (see above), desk on other. Swinging typing-shelf parks under desk drawer when shelf is not used.



handy. Important papers can be stored safely and locked in a fireproof, steel filing cabinet. There's a shelf for a waste-basket and drawers galore for storing countless "office" supplies. A built-in fluorescent light provides glare-free illumination, and a mini spotlight makes typing a pleasure.

The unit is designed around a two-drawer, metal file cabinet and built largely from ¾ in. plywood covered with handsome wood-grain plastic laminate.

File cabinets come in various sizes, but to obtain a regulation desk height of 30 in. and a standard typing shelf of 26 in., you must select a cabinet that measures 29¼ in. high. Width and depth are not so important; the cabinet shown measures 15 in. wide and 27¾ in. deep.

The chest consists of three separate sections—a center section and two wings. The cutting schedule on page 182 shows how the 16 basic parts can be economically laid out on two 4x8-ft. sheets of ¾-in. plywood. Although it costs a bit more than common fir plywood, cabinet-grade, lumber-core plywood was used in the original. It is less



PHOTOS BY ROBERT D. BORST

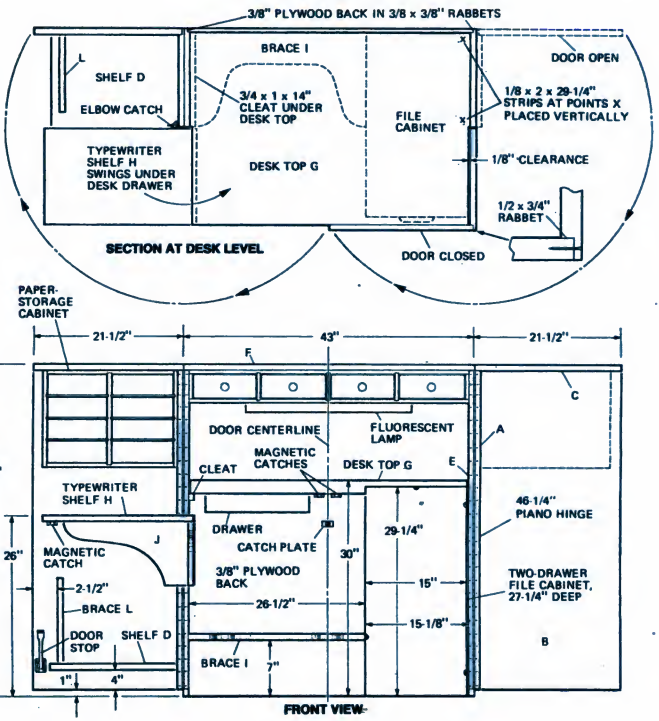
A lot of 'office' in less than 4 ft. of space

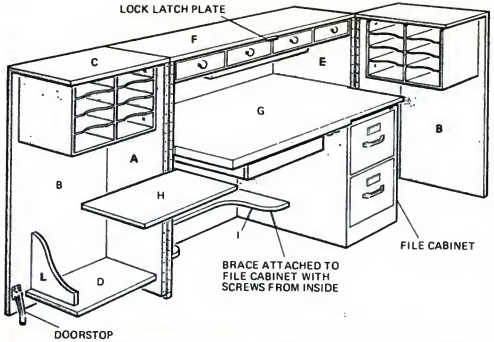
susceptible to warpage and has a smoother surface for painting.

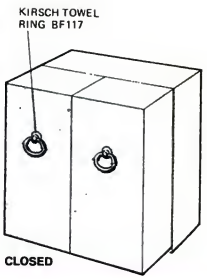
Begin making the center section which includes parts E and F. Parts E are 14⅝ x 47⅝ in., part F is 14⅝ x 43 in. A ⅜ x ⅜-in. rabbet is cut along the rear edges of all three parts, and a ⅜ x ¾-in. rabbet is cut across each end of part F. Glue and nail part F to parts E, then enclose the back with a ⅜-in. plywood panel, 42¼ x 47⅝ in. Glue two 2 x 29¼-in. strips of ⅛-in. tempered hardboard vertically to the inside of part E (see top view, page 78) at points X, front and back. These will bring the file cabinet flush with the right-hand side of the desktop and provide clearance for the right-hand wing.

Make the desktop and drawer next, as detailed on page 182. Remember that dimensions given accommodate a 15 x 28-in. file cabinet. Note that the top is ⅜ in. wider at the back than the front and that it's made double-thick except where it rests on top of the file cabinet. A ¾ x 1 x 14-in. cleat is screwed to the inside of part E (29¼ in. high) to support the desktop along the left-hand edge. Holes are made in the

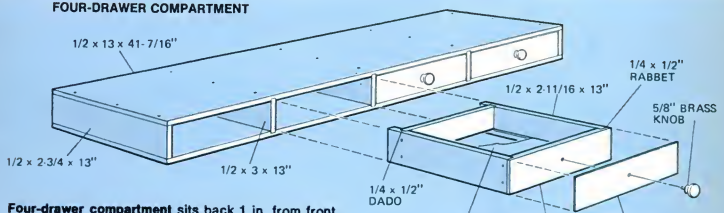
(Please turn to page 182)





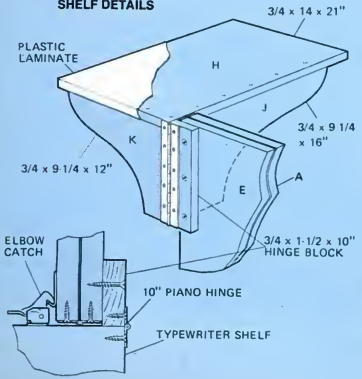


FOUR-DRAWER COMPARTMENT

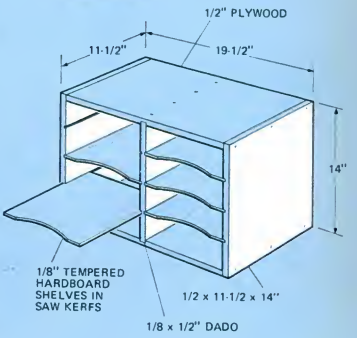


Four-drawer compartment sits back 1 in. from front of chest to provide room for a lockset striker plate that is screwed to the underside of part F and used to align wings with top of chest when closed.

TYPEWRITER SHELF DETAILS



PAPER-STORAGE COMPARTMENT



A desk for the man who likes plenty of room

Here's a fun project intended to brighten the environment of a home office, whether you use it full time or just for extra work that you bring home from time to time. The clean and simple design is devoid of frills and gingerbread.

Because it is extra sturdy, with plywood doubled-up to obtain a 1½-in. thickness throughout, and entirely covered with plastic laminate, the desk is not "cheap." As shown on the facing page, it costs about $325 to make, but similar-type units that



are offered commercially run $600 and up.

You'll need six 4x8-ft. sheets of ¾-in. plywood plus four large sheets of Formica: two 4x8 ft., one 4x6 ft. and one 4x9 ft. Your local supplier may not stock them but can usually fill such an order in a week.

Be sure to lay out and mark all pieces of plywood for cutting; remember to allow ample waste for the saw-blade kerf. When laying out the Formica allow at least ⅛-in. extra overall to provide an overhang when the laminate is applied to the plywood. If







1. Two-level desk lets you spread out work without mess, features secretary return with top at right height from floor (26 in.) for typing.

2. Drawer in secretary return has hardboard slides that serve as paper-supply trays and compartment for pencil sharpener, office supplies.

3. Deep drawer and pencil drawer hold large supply of office materials. Extra kerfs cut in drawer sides let you shift dividers as need arises.

4. As handsome from rear as from front, desk has clean, contemporary styling to go with almost any decor. Formica surfaces minimize maintenance.



the laminate is to be cut on a table saw using a carbide blade, lay out the pieces to be cut on the good side. If you'll use a sabre saw that's equipped with a fine-tooth hacksaw blade, lay out the pieces on the back side and provide good support to prevent any chipped edges (from saw chatter and flopping laminate).

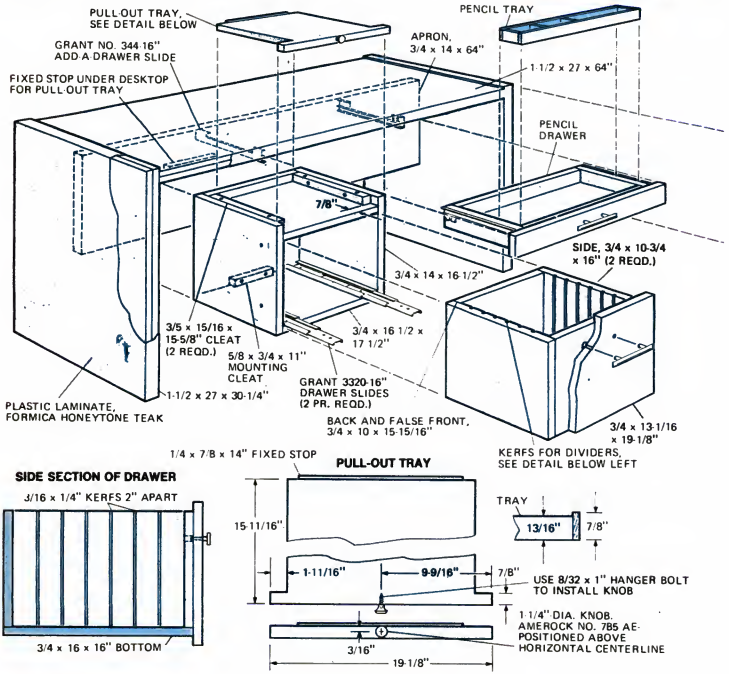
With all pieces cut and marked for identification, assemble the desk and return without glue to check for fit. If you're working alone, lay the setup on its back so you will have no trouble supporting the weight while you position and fasten the wells for the two deep drawers.

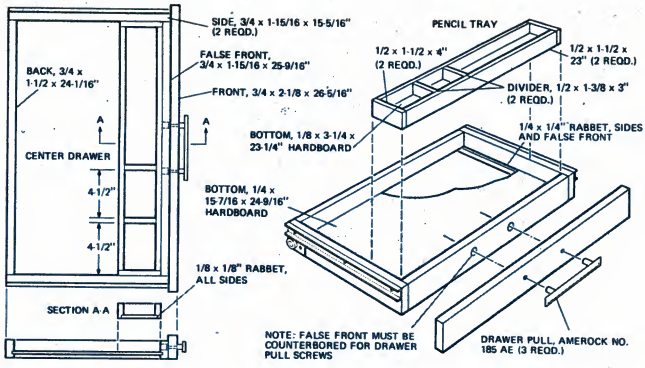
Next, the two units can be uprighted for temporarily joining the return to the desk. A simple method here is to use a handscrew (clamp) on the end leg of the desk at desired height. The apron, or back, on the secretary return can be rested on this clamp while you make final measurements and fit the filler blocks and stop under the desk top. When you are satisfied with all fits, including the three drawers' sliding action, disassemble the piece.

Take time to think out the laminating steps and, in fact, consider jotting down the sequence so you won't run into trouble. (It may prevent a ruined piece of laminate.) Laminate all parts except those which must be left uncovered so that the desk and return can be permanently assembled.

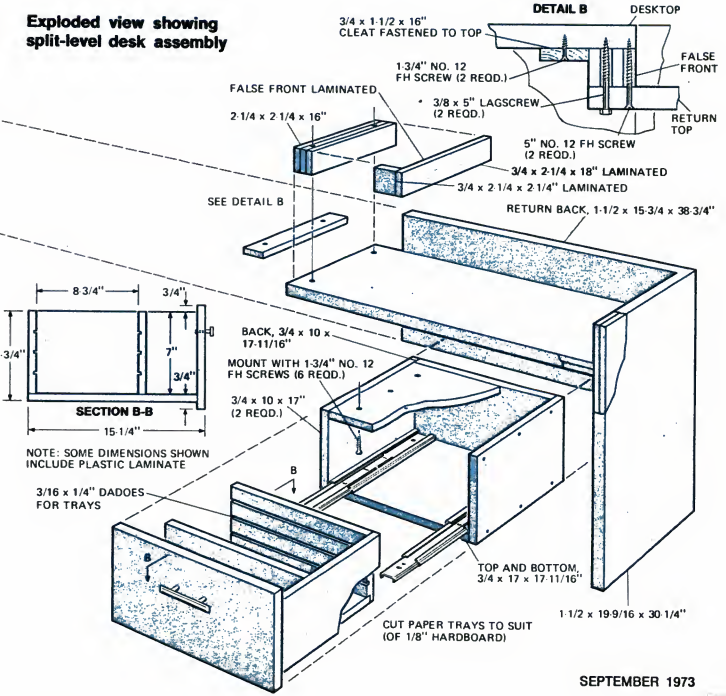
To assemble the desk, again work with it lying on its back. Fasten the ends to the

(Please turn to page 176)





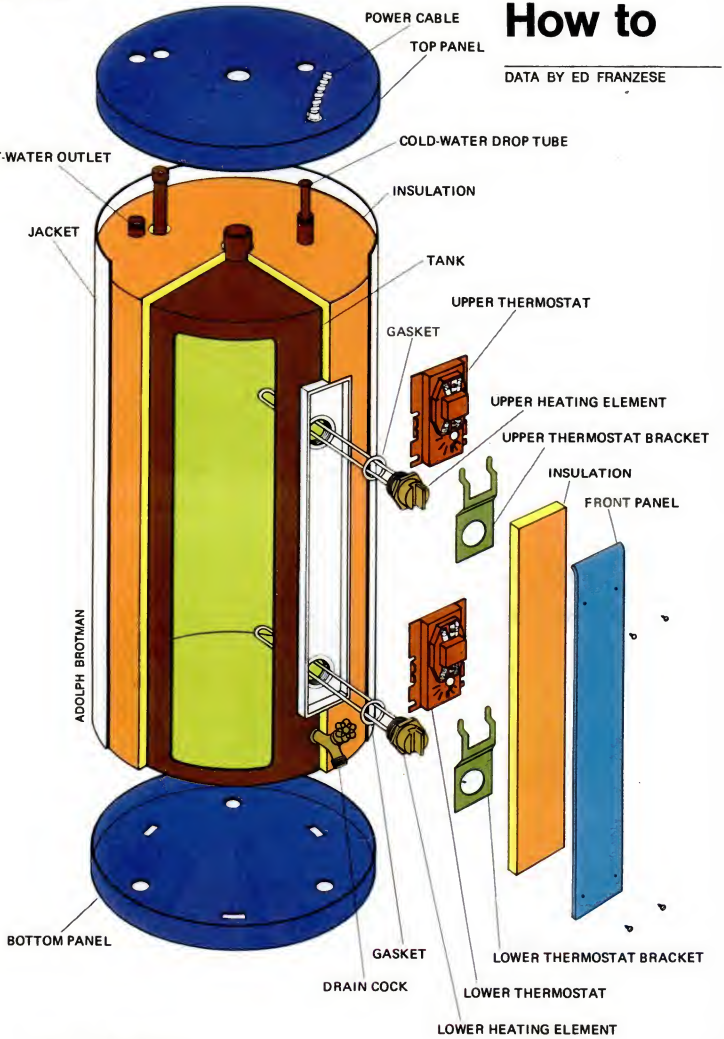
Exploded view showing split-level desk assembly



Typical electric water heater

How to

DATA BY ED FRANZESE



troubleshoot a water heater

If your water heater fails to perform satisfactorily, the fault may not lie within the heater at all. Leaking faucets or hot-water demands in excess of heater capacity may be the problem, or impure water may have damaged the heater and thus caused the trouble. The charts on the following pages will help you pinpoint and correct most common hot-water problems. The illustration at the left shows the major parts of a typical electric water heater and their locations. Other illustrations show components made by different manufacturers, and gas-heater details.

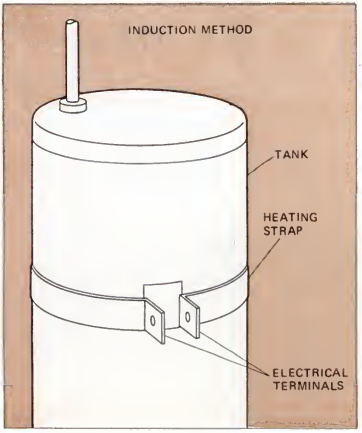
Average monthly hot water requirements

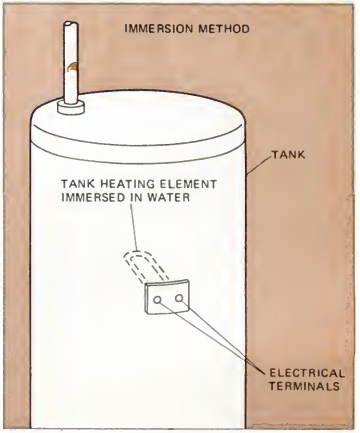
FAMILY SIZE	CONSUMES PER MONTH
2	700 gallons
3	950 gallons
4	1200 gallons
5	1450 gallons
6	1700 gallons
7	1950 gallons

A water heater is basically a storage tank. Cold water enters through the top and goes to the bottom through a pipe called a drop or dip tube. The water is heated by either electric elements or a gas burner, rises to the top of the tank, and is discharged through the outlet pipe there. Thermostats are used to regulate the heat source in order to maintain a constant water temperature within the tank.

Hot-water requirements vary with different family sizes, locations, washing methods and the number of water-using appliances in the home. A tub bath generally requires 7 or 8 gal. of hot water, a quick shower 2 to 3 gal. A dishwasher will use 9 gal. for each load; washing dishes by hand will use from 2 to 7 gal. Figures in the chart at left are average. When replacing a faulty heater, estimate the tank size you need by dividing the number of gallons shown for the number of people in your family by 30. This gives your average daily hot-water requirement, which is also the

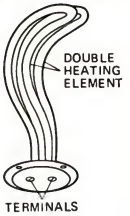
Methods of heating water electrically

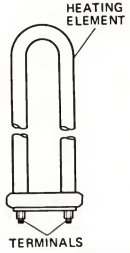


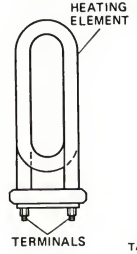


No hot water

IMMERSION HEATING ELEMENTS

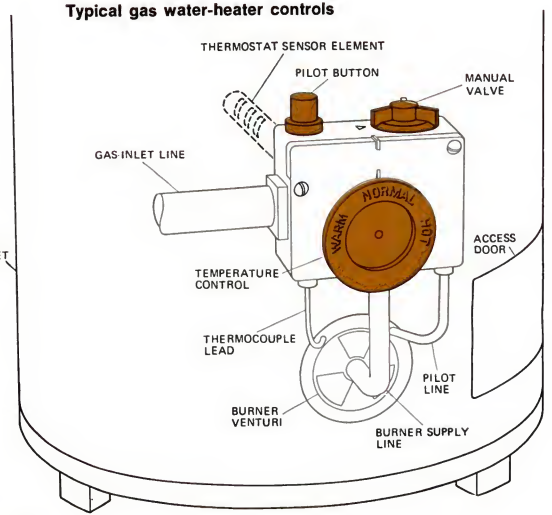






POSSIBLE CAUSES	WHAT TO TRY
1. Blown fuse.	Replace fuse. If new fuse blows, a short circuit exists in water heater. Disconnect power. Remove panel and make visual inspection of wiring. If wiring is good, call serviceman.
2. Heating element burned out.	Disconnect power. Place continuity tester across heating-element terminals. No reading indicates an open coil in element. Before replacing immersion-type element, close cold-water inlet valve and drain tank past element. Install new element. Refill tank, check for leaks and turn on power. On band heaters, loosen snap or bolt, slip band off tank and replace with new one. Retighten fasteners, replace insulation, turn on power.
3. Calcium buildup on heating element (immersion type).	Remove element. Use a vinegar-and-water solution to clean off all calcium deposits; then reinstall element.
4. Thermocouple defective (gas).	Clean pilot orifice. Turn thermostat valve to Pilot. Depress pilot button and light pilot. Hold button in for 30 to 40 seconds. If pilot fails to stay lit, replace thermocouple.
5. Thermostat defective (gas).	Turn thermostat valve to On position and temperature control to Hot position. Run hot water. If burner fails to light after two or three minutes, replace thermostat.

Typical gas water-heater controls



Not enough hot water

POSSIBLE CAUSES	WHAT TO TRY
1. Thermostat setting too iow.	Turn setting to Normal (140°-150° F.).
2. Lower heating element burned out (Immersion type).	Turn off power. Check element with continuity tester. No reading indicates an open coil. Replace.
3. Undersized tank.	Check quantity of water used by family and appliances. See hot water requirements chart.

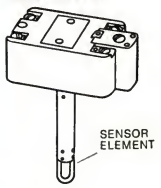
Slow recovery between demands

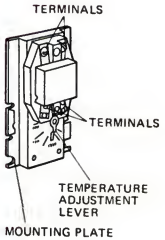
POSSIBLE CAUSE	WHAT TO TRY
1. Top heating element burned out.	Turn off power. Check top heating element for continuity across terminals. If there is no reading, replace element.

Steam in hot water

POSSIBLE CAUSES	WHAT TO TRY
1. Thermostat contacts burned (electric).	Look for shorted or burned terminals. Replace thermostat.
2. Thermostat set too high.	Lower setting to Normal (140°-150° F.).
3. Thermostat runaway (gas).	Check whether thermostat is cutting off main burner. If burner fails to go out when temperature control is turned to Low, replace thermostat.

THERMOSTATS





tank size needed. To be on the safe side, allow a little extra capacity. For example, a family of five consumes 1450 gal. of hot water per month; 1450 divided by 30 is about 48 gal. A 50-gal. heater is indicated.

Recovery time is the time a water heater takes to replace hot water. A minimum recovery rate would be eight hours to heat a tankful of 50° F. water to 150° F. This would allow the heater to recover overnight, so a family could start the day with a new tankful of hot water. For practical reasons, most water heaters sold today have a much quicker recovery rate than eight hours.

Any hot water that goes to waste will, of course, leave less hot water available to use. A leaking faucet is one of the most common forms of water waste. A slow drip—about one drop per second—wastes about 200 gal. of water a month, 5 tankfuls in the case of a 40-gal. heater. A more serious leak, such as a smooth stream that runs about 3 in. before breaking up into droplets, wastes about 1000 gal. a month. Other factors in hot-water waste are the amount of water standing in pipes and the number of running feet of pipe in the system; they should be taken into account when you plan any new water-heater installation.

There are two types of electric water heaters, induction and immersion. An induction heater has a heating element strapped around the outside of the tank and covered with insulation. Heat passes through the wall of the tank to the water. In an immersion heater, the heating elements (usually two) pass through the tank wall directly into the water, with flanges and gaskets to keep the tank watertight where the elements enter. Some common types of immersion elements are shown on page 86. The wattage rating of the elements and the size of the tank will determine the time required for water to reach the desired temperature (recovery time). A large tank, holding more water than a small one, will also naturally require more electricity to heat a tankful of water.

A typical two-element, electric water heater has a "load-limiting" circuit to keep

High water-heating cost

POSSIBLE CAUSES	WHAT TO TRY
1. Leaking hot-water faucets.	Replace washers in all leaking faucets.
2. Thermostat setting too high.	Turn thermostat to Normal setting (140° to 150° F.).
3. Scale deposits appearing on heating elements.	Remove and clean elements. See "Not enough hot water," page 87.

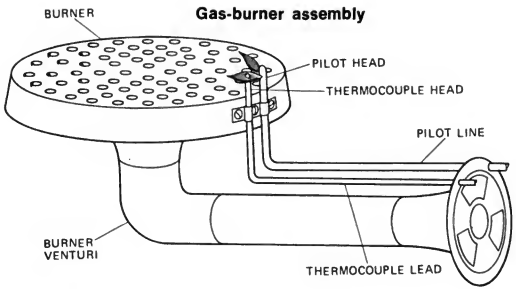
Water under heater

POSSIBLE CAUSES	WHAT TO TRY
1. Thermostat leaking.	Check flange and gasket around thermostat. Replace gasket if leaking.
2. Plumbing connections.	Check all sweated (soldered) connections in and around tank. If leaks are found, make any necessary repairs.
3. Condensation.	Check for moisture buildup in insulation if basement is cold or damp. Moisture resulting from condensation will not drip steadily as it would from a leak.
4. Leak (hole) in tank.	Use boiler plug for temporary repair if hole is accessible. Replace tank eventually.

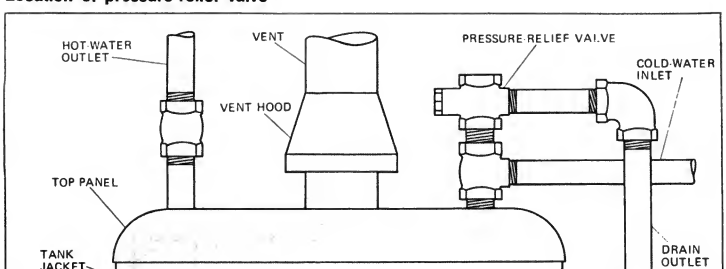
Water black or discolored at faucets

POSSIBLE CAUSE	WHAT TO TRY
1. Magnesium in water.	Magnesium rod in tank is probably corroded. Shut off power and water supply. Remove metal band or screws from top panel of water heater. Remove insulation and then remove head of magnesium rod with socket wrench. Replace with a new rod, using sealer or Permatex on threads. Reassemble, turn on water and power. Allow about 24 hours for the lines to clear.

Gas-burner assembly



Location of pressure-relief valve



both elements from drawing current at the same time. It operates as follows: With a tankful of cold water, the upper (secondary) heating element is turned on by the upper thermostat. About 25 percent of the total volume of water in the tank is heated by this element. The lower (primary) element is turned on only when the upper thermostat has sensed that the water at the top of the tank has reached the desired temperature and is ready for use. The lower element now heats the remainder of the water in the tank. If some of the hot water is used, cold water entering the tank through the drop tube is heated by the lower element. When all the water in the tank has been heated, the lower element is turned off by its thermostat. In the load-limiting circuit, wiring is usually color-coded with a blue lead to the upper element, a yellow lead to the upper thermostat and then to the upper element's other terminal, a red lead to the upper thermostat and then to the lower element and a black lead to the lower thermostat and then to the lower element's other terminal.

Gas water heaters have a single immersion thermostat, located near the bottom of the heater, a burner and a thermocouple-governed pilot light. Heater controls are a temperature dial, a pilot reset button and a manual valve with OFF, PILOT and ON positions. A thermocouple screwed into the base of the thermostat is attached to the burner and enveloped by the pilot flame. Gas from the main line enters the thermostat at one side.

The gas water heater is lit as follows: The pilot button is depressed, the pilot light is lit with a match or igniter, and the pilot button is held down for 30 to 45 seconds. The pilot flame striking the thermocouple head makes it generate a current that actuates a magnetic valve in the thermostat; this is a safety device that shuts off the supply of gas to the pilot light when it goes out. The pilot button is released and the manual valve is turned to the ON position. The burner is now lit by the pilot light.

If the burner does not light, turn the temperature dial to a higher setting, then return it to NORMAL. The thermostat maintains a constant water temperature by means of a bimetal or bellows regulating the supply of gas to the burner.

With both types of water heater, a pressure-relief valve is installed in the cold-water line just above the tank. This valve gives protection from pressure buildup in case of thermostat failure. Most of these valves are set 25 to 35 pounds per square inch above normal water pressure, to a maximum of 125 p.s.i. Valves may be spring-operated and resettable or replaceable lead plugs that melt at high temperature.

Normal hot-water temperature is 140-150° F. Most water heaters also have temperature settings for WARM, about 120° F., and HOT, about 160° F.

Because water often contains corrosive impurities, water-heater tanks are made of copper or glass. In addition, some heaters also have a magnesium-rod anode. Corrosive agents will attack the rod instead of the tank, but when the rod has become badly corroded, it will discolor hot water and must be replaced. ★★★

How to fell, buck and limb a tree



Study the tree first

The initial step is to closely examine the tree to determine which way it will fall. Although almost every tree leans in some direction, just how the tree will actually fall depends upon how you make the felling cuts. Even in relatively open country, the direction of the fall is important. There may be other trees in the area that you do not want damaged.

When working in close quarters, you are well advised to use a hefty guy rope tied near the top of the tree and a pulley. Have a helper put a strain on the rope to guide the falling tree. The pulley keeps him out of the path of fall.

Basically, there are three reasons why a homeowner has to take down a tree on his property: 1. Room is needed for an addition; 2. The tree has died and poses a safety threat with the first heavy windstorm that comes along, or 3. A dense cluster of trees requires some prudent thinning.

There are, of course, correct methods for felling, bucking and limbing trees that will make the job easier and—more important—safer. For example, when felling trees, one of the first rules to observe is to always *make gravity work for you.*

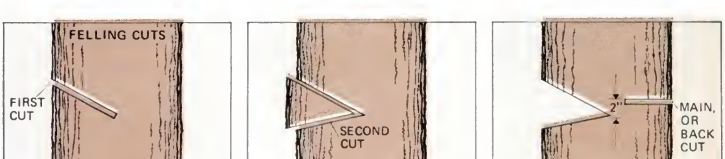
However, this often is not possible in crowded suburban areas. The tree is, just as likely, leaning toward your or a neighbor's house or garage. Here it is essential to cut the tree down in stages, using ropes to make certain that the tree limbs and trunk pieces will fall exactly where you want them to.

Felling a tree with a handsaw or ax is now a thing of the past. A gas or electric chain saw is the only way to go, but it must be used correctly. If you don't own a chain saw, it is well worth the few dollars it will cost to rent one.

Planning pays off. Before starting, take the time to study the wind's direction and velocity. These factors will have a direct bearing on how the tree will fall. *Don't ever attempt to bring down a tree in a heavy or gusty wind.*

Be sure you have a clear escape route. It should be at an angle of 45° in the opposite direction from the line of fall. Play it safe and clear away all potential obstacles along your escape route—tools, ropes and the like—before you start the felling operation.

Felling of large-diameter trees and trees in crowded suburban neighborhoods should never be attempted by an amateur. Unless you have full confidence that you can drop the tree where you want it, in the long run you'll save money and aggravation by calling in a professional to do these more difficult jobs.



Basic sawing techniques—notching and felling

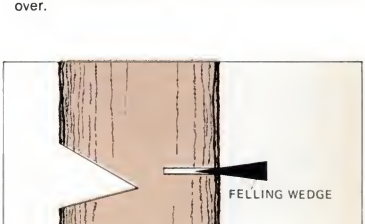
Done properly, it takes three cuts to fell a tree: two passes to make the undercut (notch) and a back cut on the opposite side of the trunk. If you are a beginner, mark all three cuts waist high on the tree trunk with chalk. The notch should be cut in the sequence shown above to a depth of approximately one-third tree diameter, and perpendicular to the line of fall. After making the first two cuts, remove the wedge from the trunk.

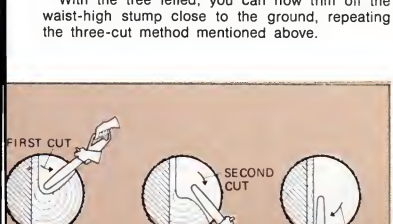
Make the back cut at least 2 in. higher than the notch so as to leave a "hinge" of uncut wood to guide the tree over. *Do not cut through the notch.* Besides guiding the tree, the hinge will also prevent the tree from twisting as it falls. As the tree starts to fall, pull your saw free. Immediately turn off power and retreat quickly along your preplanned escape route. From here on, gravity takes over.

When to use a felling wedge

If you suspect the tree may not fall in the desired direction, or may tilt back causing the saw to bind, do not complete the back cut. Withdraw the saw and use wood, plastic or magnesium wedges to open the cut and tilt the tree in the desired direction of fall. *Caution: When using wedges, make certain the chain saw does not come into contact with wedge or the saw will kick back.* Felling wedges are available at most chain-saw dealers or you can cut your own of hardwood.

With the tree felled, you can now trim off the waist-high stump close to the ground, repeating the three-cut method mentioned above.



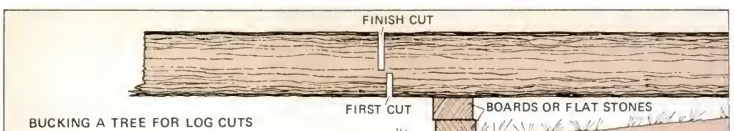


Sawing sequence for large-diameter trunks

As a rule of thumb, large-diameter trees (up to twice the chain-saw-bar length in diameter) should be handled by a professional; cutting one down is not a job for a fledgling woodcutter. However, if you are confident of your tree-felling ability, and the tree is standing out in open terrain, you should always use felling wedges in the manner described above.

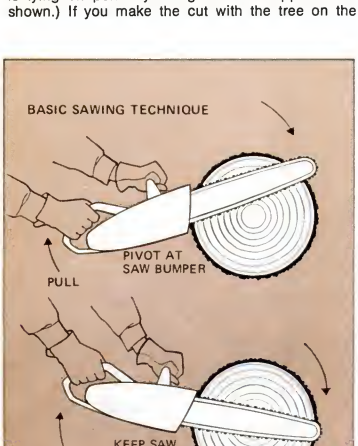
To fell a large tree, use a series of cuts as shown at left. Notice that the cuts are made so that the third and final cut leaves the hinge wood parallel to the notch cut. This is a must, so make the cuts with maximum care.

MOR



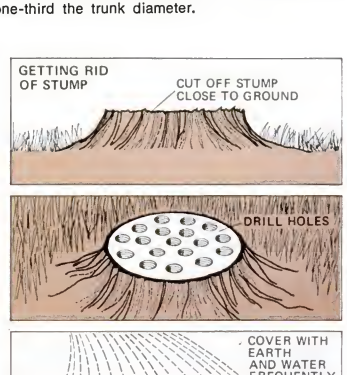
Relieving stress is necessary to cut through logs

Once the tree is down, keep in mind that the wood is heavy and that it will bend and pinch the saw if improperly supported. (The trunk will weaken at the point where you make the cut unless the tree is lying on perfectly flat ground or supported as shown.) If you make the cut with the tree on the ground, don't let the saw's chain dig into the earth; it is harmful for the saw, and you stand a good chance of being struck by flying debris. To cut the trunk, use the bucking and two-cut sequence shown. The first cut should be no deeper than one-third the trunk diameter.



Cutting up a small-diameter trunk

Most homeowners cut up a felled tree trunk for fireplace logs—usually about 24 in. long. When the trunk is of a diameter smaller than the saw's bar length, the cut can be made in one pass if the tree is supported properly as described above. If necessary, to avoid the cut closing on the bar, insert a wedge into the cut to hold it open and away from the bar. Start the cut with the saw's bumper snugged against the tree trunk and with the blade held at an angle. Holding the saw firmly, fully open the throttle and slowly lower the traveling chain into the wood. Keep the throttle full-open throughout the cut.

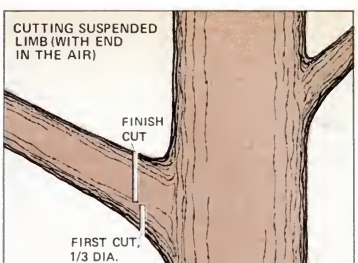


Getting rid of the tree stump

The most popular method of getting rid of a tree stump is by burning. Present environmental conditions now make this not only undesirable but, in most areas, illegal. The alternatives?

1. Dig out by hand, cutting away sections of root as you go. If you must remove the stump immediately (to make way for a footing, for example), you are well advised to call in a professional nurseryman with his power equipment which will chip out a stump in a half hour or less.

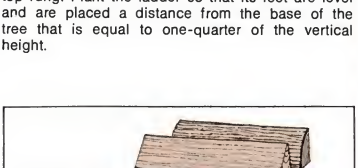
2. The cheapest way to eliminate a stump is to simply bury it. Cut the stump off close to the ground and cover it with soil. To speed the rotting process, bore holes 6 in. deep before burying. For aesthetic reasons, cover the mound with ground-cover plantings. To speed the rotting process, water frequently.



Limbing a tree

There are two things to guard against when limbing a tree: First, the possibility that the cut branch will whip back in the direction of the woodcutter, and second, the impulse to work from an improperly positioned, thus unsafe, ladder.

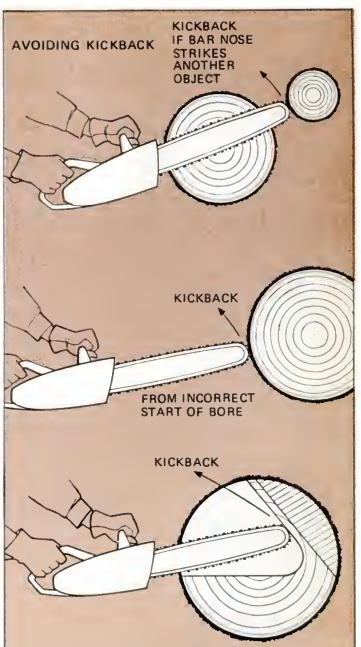
To prevent the first, use the cutting sequence shown. To saw off a large limb supported only by the trunk, first cut one-third of the way through the limb on its underside. Make second cut through the limb from the top. Make certain you lash the ladder securely to the tree. Run a rope around the trunk a couple of times, then tie it securely to the top rung. Plant the ladder so that its feet are level and are placed a distance from the base of the tree that is equal to one-quarter of the vertical height.



Stacking fireplace logs

For use as firewood, the logs should be stacked and allowed to dry out before splitting. Splitting goes quickest if you use a steel splitting wedge and a sledge rather than an ax. And it's a lot safer.

A good method of storing firewood is shown above. Twelve or fourteen logs may be stored in this manner without danger of toppling over. If you are interested in knowing just how much fuel you have accumulated, one cord of wood equals 128 cu. ft. Assuming you've cut your logs into 24-in. lengths, it would take a pile 16 ft. long and 4 ft. high to equal this volume.



Avoiding kickback

When cutting with the nose of the bar, take extra care to protect against chance of saw kickback. It will occur when any of the three conditions illustrated above exists.

Safety rules you should always observe:

1. Think the job out beforehand and stick to your plan.
2. Plan an escape route at 45° angle opposite the direction of tree fall.
3. Wear a hard hat if there is any chance of timber or branches falling from above.
4. Don't wear loose-fitting clothing. It could become caught in the chain saw or falling limbs. Always wear work gloves.
5. If your job collects a crowd, stop. Keep bystanders, especially children, clear of your cutting site and area of tree fall.
6. Work only with a sharp saw chain. ★★★

How to close up your vacation home

DATA BY JOHN GAYNOR

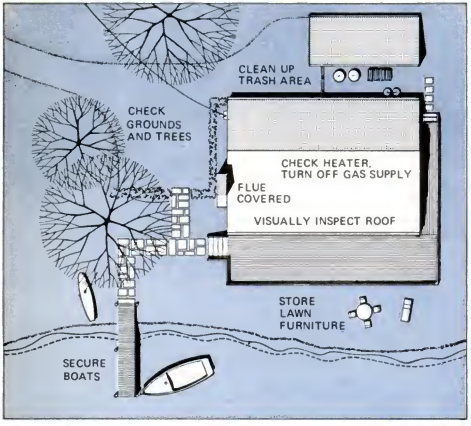
With the end of summer fast approaching, now is the time to think about "battening down the hatches" at a vacation home which will be unattended during the winter months.

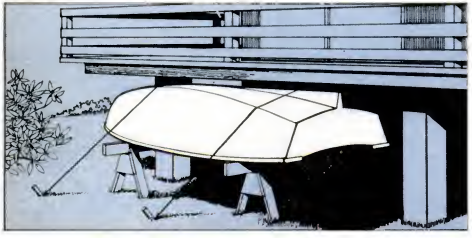
Many of the closing-down chores are things you've done year after year, and most of the items listed on these pages are simply common sense. But, if you make up a list and assign each member of your family specific tasks, the closing-down will go a lot faster—without chance of missing any important items.

You can usually hire a local resident who, for a nominal fee, will keep an eye on your place during your absence. To avoid misunderstandings, agree upon his fee and what services he is expected to perform.

Finally, check your homeowner's insurance policy to see if any conditions must be met to assure your policy remains in full force during your absence.

Grounds, dock and boat check



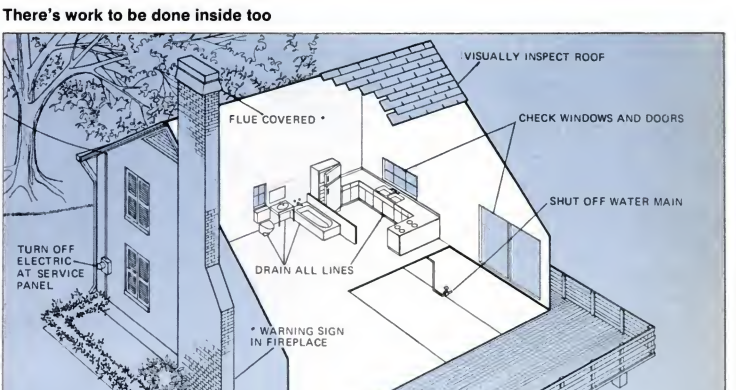


Start with inspection of house exterior and grounds. Look for, and remove, broken or dead tree limbs or trees which may be leaning dangerously toward your house. Your "checklist" tour should include the following:

1. Clean out gutters and leaders.
2. Repair any loose roof shingles.
3. Point up any loose chimney bricks.
4. Clear *all* accumulation from the crawl-space area.
5. See that garbage cans have properly fitting covers. Scrub the cans with disinfectant and soap and water. When dry, store them out of the weather. Throw out damaged and uncovered cans.
6. Keep out vermin by covering chimney flues with a galvanized sheet-metal cap, securely fastened. *Immediately, upon fastening flue cover,* go inside and put a *big sign* on the fireplace to assure you *uncover flues* prior to use next season.

If possible, your boat should be drydocked. This may be: 1) at the local marina, 2) at your year-round home after a trailer tow or 3) stored on your vacation-home property. Items 1 and 2 simplify your task considerably. If you elect to do your own storing, follow these simple guidelines: Pick an area near the house on the opposite side from prevailing winds. A small boat can be inverted and stored on sawhorses; just make certain it is lashed down securely with a stout cord. With boat stowed, check your dock, mooring lines and accessories for any loose gear which may be stored in and lashed to the boat. Larger boats can be stored on a trailer but provide maximum protection against weather damage and vandalism.

There's work to be done inside too



Scatter a liberal number of mothballs around the house, in each room. Mothballs will be easier to gather than flakes next spring. Also place mothballs between mattresses and springs. Since camphor evaporates when exposed to air, you may wish to have your "caretaker" replenish the supply every six weeks or so. *Do not set rodent traps.* Decomposition over the winter can cause an odor that will be difficult to elliminate. A strong camphor odor will deter most rodents from entering the house.

Clean out all foodstuffs. Food packed in cardboard containers (cereals, flour and the like) will attract rodents and other vermin. Foods packaged in cans and bottles may be subject to below-freezing temperatures and stand a good chance of exploding. At best, they will probably outlive their shelf lives if left behind. Your best bet is to remove all food from your vacation home before leaving. For economy, of course, bring home what you can. Add what you decide isn't worth packing to the pile of trash that is to be hauled to the dump.

Before locking the front door, make a final check to assure that all combustible materials—paints, solvents, cleaning fluids, matches and the like—are removed from the house. Turn the heater switch to off, shut off the gas supply at the main and pull the main electric fuse (or trip the breaker). Finally, check screens, windows and doors to make certain they are firmly secured.

Shut off water-supply main and drain *all* water-supply lines. Open valves on fixtures, drain fittings at their lowest points and leave valves open. A small amount of water may remain in the valves. To remove it, rig a section of hose to the pressure side (outlet) of your vacuum cleaner and blow out the fixtures. If your summer home is closed while the climate is still moderate, small amounts of water remaining in valves and lines left open will evaporate prior to freezing weather. Drain or siphon water from the toilet-bowl tank and remove the last bit with a sponge. Pour about a cup of permanent-type antifreeze in every trap. (Don't forget, the bathtub drain has a trap too.) Pour *two* cups of antifreeze in the toilet bowl. Water-pump and well-point systems vary depending upon the type installation. Here, it is best to have your plumber show you what to do the first-time around. Write down what he tells you for use next year. (You may have a foot-valve type point, a flexible submersible point, or other: "Breaking" the vacuum by needless loosening of fittings can shorten the life of the fitting.)

Final points: Make certain your washed-down refrigerator is propped open. Also, it is worth the few dollars more your caretaker will charge to have him clear the driveway after each snowfall. In the event that fire should break out while the house is closed, a clear access could spell the difference between minimal damage and total loss. ★★★

'Combat cops' fight crime like commandos

by Frank Datnow



PHOTOS BY JAMES H. PICKERELL



Special combat-trained police (above) are organized into five-man teams. Each consists of a team leader equipped with a .223 AR-15 semiautomatic rifle, an observer packing an Armalite 180, a scout also with an Armalite, marksman carrying a .234 Remington with telescopic sight, rear guard or "back-up" man armed with a 12-gauge shotgun.

In simulated raid, paramilitary police take cover against a hidden sniper, looking more like infantrymen storming an enemy-held position than cops on city street. In actual "battle" conditions, men wear protective helmets just like field troops. Old movie sets like this one are often used for training exercises.

Equipped with high-powered rifles, flack vests, gas masks and other military-type field gear, a small band of men prepares to close in on a dangerous barricaded sniper. Except that their uniforms are of traditional police blue, they look more like combat troops than cops. Yet cops they are—a new breed of heavily armed, combat-trained crime fighters developed specifically to meet the rising tide of political terrorists, drug-crazed desperados and hardened killers now appearing on American streets.

The emergence of the so-called "urban guerrilla" has made such conventional police weapons as the billy club and .38 revolver as outmoded as bows and arrows against machine guns. As a result, law enforcement agencies all over the country are training special elite paramilitary police units to fight back-alley gunmen in the same way as an enemy in the jungle. One of the most highly rated of these is a branch of the Los Angeles Police Department known as Special Weapons and Tactics, or SWAT for short. SWAT headquarters is in a downtown Los Angeles "command post" from which its mobile units can be dispatched in minutes by radio to any part of the city as soon as an alarm call comes in indicating a crime situation that may be too serious or massive for local police to handle alone. This is when SWAT forces swing into instant action.

SWAT units are organized into five-man teams, each with its own leader, usually of sergeant rank, equipped with a .223-cal. AR-15 semiautomatic rifle. His teammates consist of a "scout" equipped with an Armalite 180, a rifle of the same caliber as the AR-15 but with a folding stock, an "observer" also packing an Armalite 180, a "marksman" carrying a .234 Remington 700 with a high-power telescopic sight, and a "rear guard" toting a 12-gauge shotgun. They all carry sidearms as well. Like infantrymen, they wear flack vests, helmets, and web cartridge belts with canteens, ammo pouches, first-aid kits, tear-gas canisters, gas masks, signal lights and other gear.

Each team member has a specific job to do. The scout usually takes the "point," going in first to assess the situation before others are deployed. The marksman is the "long rifleman." From a rooftop or other distant vantage point, he can pick off a sniper hundreds of feet away—an impossible task for an ordinary policeman equipped only with his service revolver. The rear guard acts as a "back-up" man to protect the team against an attack from behind or to move in quickly if others need help. Last year alone, SWAT forces were called into action 46 times—on the average of nearly once a week to handle a major crime or potential riot. Their valor and effectiveness have proved the combat cop is America's new hope in the war on lawlessness. ★★★





Men in "ambushed" patrol car above learn how to fight their way out of such traps using their vehicle as cover for protection. Training program includes practice in handling all emergency situations that may arise. At left, team leader displays portable field case containing high-powered rifles, ammunition, tear-gas canisters, gas mask and other combat gear ready for use.

Detroit promises clean-air '75s . . . but ups the sticker another $300

by Robert Lund

The toughest jobs in Detroit today are held by four guys named Meyers, Heinen, Jensen and Starkman. They are the front-line generals leading Detroit's frantic search for hardware that must be developed if carmakers are to meet clean air standards the government has ordered for 1975-76.

The auto companies have more engineers and technicians working on the engine emissions problem than they've ever assembled for any single project in automotive history. If you count all the backup help—computer programmers, model builders, test drivers, clerks and all the rest—Detroit has a minimum of 25,000 people working full time on the cleanup.

How's it going? To find out, *PM* interviewed the executives in charge of antipollution activities at the four auto companies. Namely:

Gerald C. Meyers, Group Vice President-Product, American Motors Corp.

Charles M. Heinen, Executive Engineer-Materials Engineering, Chrysler Corp.

Donald A. Jensen, Director of Automotive Emissions, Ford Motor Co.

Ernest S. Starkman, Vice President in Charge of Environmental Activities, General Motors Corp.

In answering *PM*'s questions, the auto executives did so on the basis of the best information available at the time they were interviewed. "But," the auto men cautioned, "if the government changes the rules or if there's a breakthrough in technology before you get in print, we'd change our answers to the questions."

Here are the questions and the industry's answers from Messrs. Meyers (AMC), Heinen (Chrysler), Jensen (Ford) and Starkman (GM):

On the basis of what you know now, can you meet the emission standards for 1975?

AMC: Yes.

Chrysler: We have every intention.

Ford: We don't know and won't know until final procedures for 1975 certification are established. We understand the procedures may not be finalized for several months.

GM: GM's been able to meet the emissions limits of the EPA interim standards with experimental systems operating under controlled conditions in our laboratories and proving grounds. But we don't know and won't know whether our vehicles with these systems comply with all requirements of the Clean Air Act for emissions at preproduction certification, off the production line, and after extended customer service until we have further development and field-testing experience, and until we know all test procedures that will be used by EPA to determine compliance.

Can you meet the standards for 1976?

AMC: No, we can't.

Chrysler: We've been saying we don't know how to meet them and we still don't.

Ford: We know of no way of meeting the '76 standards.

GM: The same factors apply here as for the 1975 interim limits. At this time, we don't know of any proven technology for



AMC's Meyers



Chrysler's Heinen



Ford's Jensen



GM's Starkman

meeting the stringent 1976 limits for oxides of nitrogen in mass production vehicles. We agree with EPA's indication to Congress that these limits are unnecessarily strict and should be eased, and we hope Congress will act accordingly. But as of now they are in the law, and we must continue our engineering to find a feasible way to meet them.

Are you committed to use of catalytic converters to meet the 1975-76 standards? If so, what do you estimate the cost will be to car buyers?

AMC: We'll use catalytic converters. The cost to car buyers will be $300-plus.

Chrysler: We're committed to the oxidation catalyst where it's absolutely necessary. But we don't believe the oxidation catalyst is currently in a state of development where it should be installed on cars. As you know, Chrysler is challenging the standards and we don't feel the standards are immutable. They may be changed. They should be changed. What will the catalyst cost? The oxidation catalyst alone will run plus-$150.

Ford: At this time, catalytic converters offer the only opportunity for approaching the 1975-76 standards across our full range of production. There's not enough time to tool up for other systems, even if they were available. We estimate a '75 car with catalysts will cost about $300 more than a '73.

GM: We believe our catalytic systems are the best choice of available alternatives for reducing emissions on most full-size cars, and we expect they will be necessary to meet the interim 1975 limits for cars sold in California. The interim 1975 limits for the rest of the country are so stringent we may find it necessary to use them nationwide on a variety of our cars. But we don't yet know how many or which models. We're continuing to make preparations for manufacture and installation of converters on 1975 models, including commitments to suppliers, and we're continuing development work on catalysts and system components.

We don't know at this point what the cost will be to the car buyer. It will depend on the specific emission-control equipment used on our various models and results of further development. We've said retail prices of cars equipped with systems we are now developing to meet all requirements of the law for 1975 and 1976 could be increased by $275 over today's prices.

What comes after the catalytic converter?

AMC: We don't know what comes next.

Chrysler: Without knowing what the standards will be, we don't know. The logical thing would be to get away from a hang-on and try to do the job in the engine.

Ford: We'll continue our efforts to develop new internal-combustion engine designs and alternate power sources. But we have no way of knowing now what might turn out to be viable.

GM: What will prove feasible in future development, from emissions and all other considerations, we don't know at this time. Today, our catalytic systems are showing promising results, in terms of emission-conversion efficiency and catalyst durability, also in fuel economy and driveability. We believe the catalyst's ability to clean up

As PM went to press, GM announced a breakthrough in design of a platinum and palladium-coated, ceramic-bead catalyst that promises to last the "life of the car."

pollutants not consumed in the engine, and thus insure low emissions despite engine variables, will make it the most consistent performer in customer service of any choice available to us now.

Are you looking at alternate technologies, something better and beyond the catalytic converter? If so, what?

AMC: We're looking at everything and anything anyone suggests.

Chrysler: We've been looking at alternate technologies a long time. We had a Wankel program before any of the other companies. We looked at the Honda-type engine something like 12 years ago. We've even looked at steam and electric cars. But our big emphasis has been on the turbine. We discontinued that work almost completely because of the oxides of nitrogen standard. Now that's changed—or looks like it's changed—so we're going gung-ho on the turbine again.

Ford: We've been looking at alternate power sources for some time—the PROCO (programmed combustion) engine, the Stirling, the Wankel, the Rankine cycle engine, the gas turbine and battery-powered motors.

GM: We are working comprehensively on many alternate technologies and we have been for many years—including Stirling cycle, gas turbine, battery and hybrid-powered vehicles, and modifications of the present engine, such as use of stratified charge and the rotary engine.

Honda, Daimler Benz and Toyo Kogyo say they have engines now that will meet the 1975 standards without catalytic converters. Why not use one or more of these engines or approaches to solve the problem?

AMC: There's no time left to develop these ideas to 1975 requirements.

Chrysler: If they've got the answers, more power to them. Unfortunately, none you mentioned could meet the 1976 standard as originally written. They couldn't meet the NO_x standard. But forgetting that obstacle, even if we'd completed design work on one of those engines, there would be no possibility of putting it in across the board for another 5 to 10 years. If we changed engines, the turbine is by far the most attractive.

Ford: EPA looked at some of their reported tests and made a judgment they probably could meet 1975 requirements. But they haven't said they could meet the legal requirements for 1976. There's no way we could tool up to produce such systems for 1975, then scrap the engines for 1976. The machine-tool industry told EPA it would take 12 years to retool the domestic auto industry.

GM: These engines have shown capability of meeting emission limits in controlled tests of individual cars, but they still must be proven out in mass production and normal service experience. Even if this were already accomplished successfully, there's no longer sufficient lead time to produce them for a significant portion of our 1975 or 1976 models.

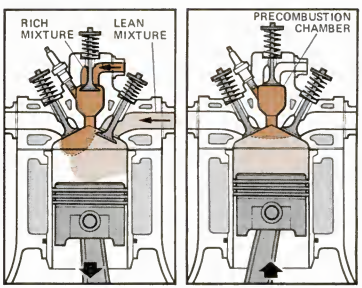
How will you use the extra year you've been given to solve the emissions problem?

AMC: We'll use it to meet the new requirements and look for alternatives.

Chrysler: We'll use it to try to develop

Detroit fiddles while Honda burns—clean

To meet 1975 emissions standards, Honda modified its engine instead of hanging on expensive catalytic converters. The stratified charge engine, which Honda calls compound vortex controlled combustion (CVCC), is used in Honda Civic. Detroit has been aware of stratified charge for years, but questions its application to larger engines for heavier cars. In the Honda engine an ohc drives three valves: two intake and one exhaust. A rich fuel/air mixture enters a small precombustion chamber, and a lean mixture the conventional combustion chamber. On compression stroke the rich mixture is packed in the precombustion chamber. This more volatile charge is ignited and the flame front travels down exploding the lean mixture which couldn't be ignited by a sparkplug alone. —*B.H.*



a catalyst that'll stand up better and to work on alternate engines. But don't discount the internal combustion engine. If they get realistic with the standards, we think the piston-type internal-combustion engine can meet the requirements. We can still do a lot with the present engine, including reactors, electronics, altitude compensators, new types of carburetion.

Ford: We need more time. But we'll use the year to continue our all-out efforts to improve and prove out catalyst technology and to develop new concepts in design of our internal combustion engines and to work on alternate power sources.

GM: Instead of the year's deferment of the 1975 standards which we'd requested, EPA established interim standards so stringent that they could well require the use of catalysts and other advanced control equipment on a wide variety of our 1975 cars nationally. To meet EPA requirements, we must begin certification tests for our 1975 cars later this year. As for 1976 cars, the very stringent standards have not yet been modified or deferred. So virtually no additional time for development and engineering has been given us by the EPA order.

The National Academy of Sciences has criticized Detroit for concentrating on the least desirable system of controlling emissions. How do you respond to that?

AMC: The Academy has perfect hindsight and ignores the time limitations imposed on the industry to meet 1975 requirements.

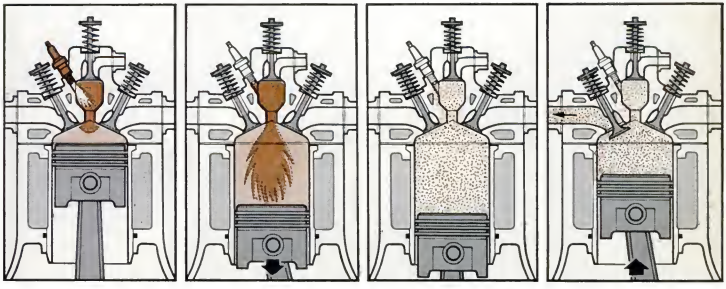
Chrysler: I'd burn out your tape recorder if I responded appropriately. The Academy is blessed with 20-20 hindsight. We said a year ago the catalyst wasn't the way to go. But EPA said the only way a company could show a good-faith effort was to get ready to put on catalytic converters. We argued against catalysts more vociferously than any other company. We said the standards were incorrect and a third have proven incorrect. I think the remaining two-thirds will eventually be deemed incorrect. We've insisted all along that the logical way to go is to improve the internal combustion engine on a low-cost basis along lines we know how to develop and are working to develop.

Ford: We don't agree with the Academy. We submitted more than 1700 pages of technical data to EPA to support our position on the advisability of catalyst technology. The Academy has yet to produce one piece of data to support its position.

GM: Although the NAS concluded that technology is available to meet the original 1975 standards, it noted many qualifications and expressed concern over the timetable. It concurred with our position that, for some time, the only hope for meeting the requirements in 1975 has been to concentrate on developing catalytic converter systems for the conventional piston-tvpe gasoline engine. ★★★

NEXT MONTH:

The '74 cars are here. Should you trade in? Hang on? Or cop out? PM auto editors in New York, Detroit and California report on how they are getting along with their cars.



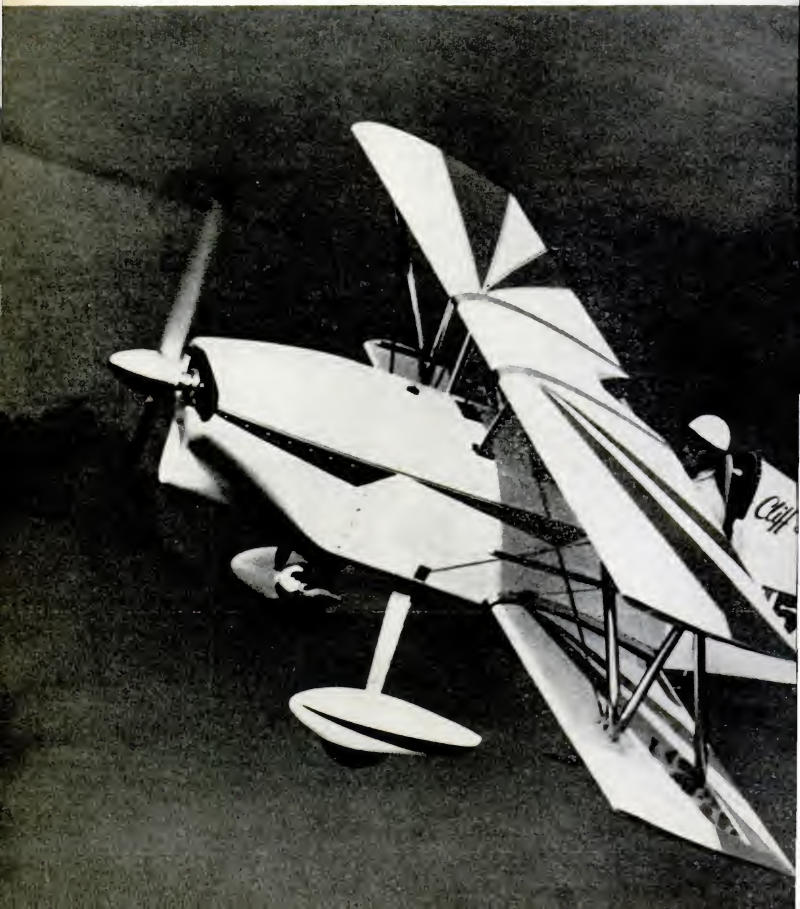
PETER TROJAN

IGNITION POWER BOTTOM DEAD CENTER EXHAUST

Modern biplane in the classic style

by Sheldon M. Gallager
and Howard Levy

PHOTOS BY HOWARD LEVY



This little two-winger has all the nostalgia of early aircraft with present-day ruggedness, performance and flyability. More than 10,000 sets of plans are already out to build-it-yourselfers.

It can look like a vintage World War I fighter or a sleek modern sport plane—it all depends on how you dress it up. The classic open-cockpit, single-seater biplane, designed especially for do-it-yourself construction, was officially commissioned by the Experimental Aircraft Assn. and developed by several of its members. The nostalgic little two-winger has proved so popular that more than 10,000 sets of plans have already been dispensed by the EAA.

For lack of a better name, the ship has been dubbed the EAA Biplane or "Bipe" for short. Its appearance and performance are more inspired than its name, however. What makes the Bipe so intriguing







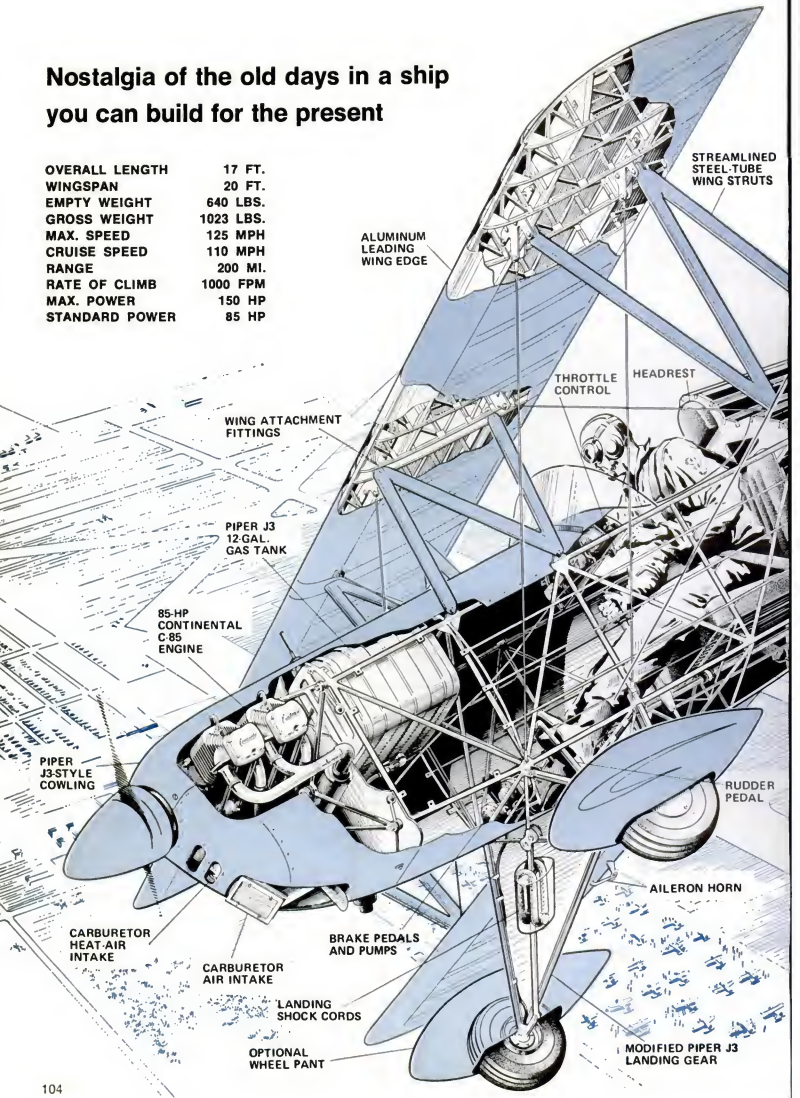


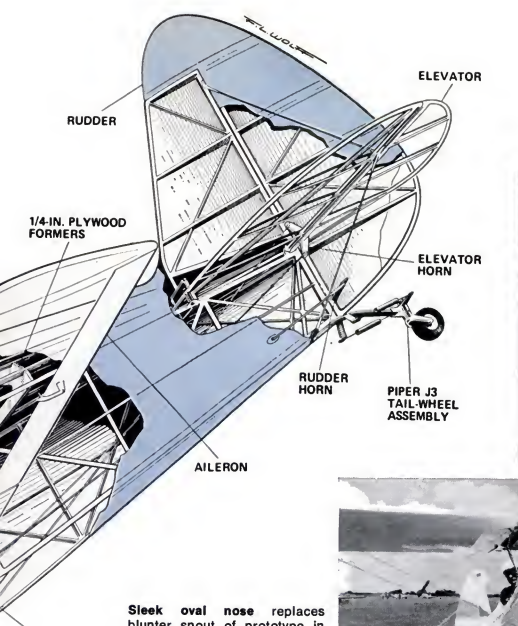


Variations in basic design show how minor modifications can make a big difference in craft's appearance. At top above is original EAA prototype, a straightforward, no-frills biplane in classic style. Slicked-up versions below it and at left on the facing page sport streamlined struts, wheel pants, colorful markings and other touches that produce a classy, modern look. Note bubble canopy added by one builder (third photo from top). At bottom, nose is given completely different, vertically elongated shape merely by omitting side cowling around engine's cylinder heads.

Nostalgia of the old days in a ship you can build for the present

OVERALL LENGTH	17 FT.
WINGSPAN	20 FT.
EMPTY WEIGHT	640 LBS.
GROSS WEIGHT	1023 LBS.
MAX. SPEED	125 MPH
CRUISE SPEED	110 MPH
RANGE	200 MI.
RATE OF CLIMB	1000 FPM
MAX. POWER	150 HP
STANDARD POWER	85 HP









Sleek oval nose replaces blunter snout of prototype in this spruced-up modification—good example of how ship can be customized to suit builder's own tastes. Cowling is fiberglass, easier to form than canvas or aluminum. Cockpit and instruments are at upper right.

is its ease of construction and versatility. Although the prototype is powered by an 85-hp Continental engine, it's stressed to take powerplants up to 150 hp. It's also easily customized by adding streamlined struts, wheel pants, fancy nose cowlings and other personal touches. At least one builder made it into a tandem two-seater, and another enclosed the cockpit with a bubble canopy.

Construction is all wood in the wings and a combination of wood and steel tubing in the fuselage. The original Bipe is fabric-covered, but a number of builders have substituted aluminum for more permanence. For simplicity, only the lower wing incorporates ailerons, and stock Piper J3 parts are used in the main landing gear, steerable tail wheel and gas tank. Overall length is 17 feet with a wingspan of 20.

On its 85-hp engine, the Bipe hits a top speed of 125 mph, cruises at 110, climbs 1000 feet a minute and has a range of 200 miles. Its official service ceiling is 11,500 feet, though some builders have pushed this to as much as 15,000 using heftier powerplants. Plans are $27 for EAA members and $37.50 for nonmembers. These are available from the Experimental Aircraft Assn., Box 229, Hales Corners, Wis. 53130. ★★★

Outdoor gear for indoor emergencies

During disaster or dimout, many new items of camping equipment can do double duty if selected carefully.

by Lewis Perdue

Floods and disasters, fuel shortages, electrical brownouts and failures keep forcing millions of Americans to try to become as self-sufficient as their ancestors once were. Camping equipment intended for use for fun outdoors can be the answer for today's city and country dwellers when civilization gets jerked out from under our feet.

When recent heavy rains changed a placid river into a torrent that rose to within inches of their door, one family kept a written record of their plight. Their home was spared, although amphibious vehicles rescued neighbors from roofs of houses nearby. But the powerplant supplying electricity for the valley was under water so lights didn't light, the trash compactor wouldn't compact, the stove couldn't cook, dishwasher wouldn't wash, refrigerator no longer functioned and the freezer lost its battle against outside heat as melting ice cream oozed down the front. Their water pump wouldn't pump—but they couldn't use that water source anyway because a rising water table had overflowed their septic tank into the well. Their oil-burning furnace wouldn't heat because its control and circulating pump were electric. The family tried to boil water and cook in their fireplace but, like the ornamental fireplaces found in so many homes, it was ill-suited for utility. The charcoal barbecue grill was not much more help.

Fortunately the family had a camping stove that could serve for cooking food and boiling water plus a lantern to shed light on these essential chores. Both were fueled with gasoline and they were able to siphon enough from their car to keep both going until electric power was restored. Looking back afterward, they realized how lucky they had been.

When faced with a long-term power interruption, the basic requirements for most families are heat to cook and warm the kitchen plus light during the night. Non-electric camping gear powered with propane or gasoline can fill these bills. If the emergency occurs during warm months, keeping room temperature up is less serious. But during blizzard or ice-storm power shortages of winter, heat conservation and fuel economy are vital.

When the heating system fails during cold weather, the entire family should limit itself to one or two rooms, and not try to heat the entire house. The kitchen is best choice as a family room, since it can be partly or completely warmed by heat given off while preparing food. The kitchen should also be used for living and sleeping, with screened-off areas to give privacy for anyone too modest for communal living. Good sleeping bags will save fuel by allowing room heat to be drastically lowered at night. Down-filled bags are best, but are expensive. A bag with at least three pounds of polyester fill usually runs a close second. Remember that some ventilation must be provided for fresh air, particularly if a combustion heater is being used.

A first question by campers and homeowners alike when shopping for campstoves, heaters and lanterns is: propane or gasoline?

Propane is more expensive, but is more convenient to use. When the demand is

Portable generators that provide such comfort around a campground can be life and money-savers when powering appliances.



HAROLD JOHNS



Campstove cookery indoors will often prove a lot easier than preparing meals in a fireplace. Kitchen can be closed up into family room for warmth or even emergency sleeping.

greatest, however, the supply of the standard 14.1-ounce propane cylinders may dwindle. If you decide on propane, it could be worthwhile to keep on hand a refillable bulk tank. It will cost more initially but allows long-term savings.

During an emergency, an adequate supply of white gasoline can also run short if filling stations cannot meet demand or power fails for their electric pumps. Regular gas can be used with some makes; with others it should be avoided except in emergencies. Additives in the gasoline can eventually clog orifices and valves, and possibly cause danger of lead contamination. It is best to keep on hand a supply of the recommended fuel, particularly for use with catalytic heaters where impurities can ruin the unit.

An advantage claimed for some liquid-fueled models is that, though they have to be pumped periodically, they can be made to work better in cold weather. Several bottled-gas LP lanterns, for instance, become dimmer as the temperature drops, and stove burners lose efficiency. Brightness levels of some propane lanterns will drop 20 to 80 percent as temperatures go from 70° to 35°. Extra pumping of gasoline models can prevent this. Coleman units use a patented LP regulator to keep temperature changes from lowering efficiency.

A single-mantle lantern will produce about as much light as a 75-watt light bulb and will burn about two ounces of propane or three of gasoline per hour. A double-mantle lantern can produce about 20 percent more light and uses about three ounces of propane or five ounces of gasoline an hour. A two-burner stove, using both burners, might need 11 ounces of gasoline per hour, while a similar propane stove should exhaust a 14.1-ounce cylinder in about 3½ hours.

Flame and catalytic heaters are available, with catalytic by far the safest in households with pets and small children. The flameless catalytic is less likely to start a fire or cause a burn. Propane-fueled catalytics are much more convenient than liquid-fueled models since no tall sooty flame is needed to prime LP heaters.

Some gasoline lanterns and stoves can burn LP gas when a converter is used. This may void the warranty, however, and like other emergency preparations should be experimented with in advance. Study instructions regarding ventilation, as well. Whether your appliances burn gasoline or propane, they use up oxygen, and their use indoors in a completely closed kitchen or bedroom could be dangerous.

Once you are prepared for emergency food, light and heat, give thought to the problems of a nonfunctioning water pump, defrosting freezer and refrigerator, and radios and TV with no power to give you reports of the disaster. When your home freezer stops running, keep it closed. Food will usually stay frozen for two days in a fully loaded freezer and at least a day in a half-loaded one. If it's winter and the temperature is not likely to rise above freezing outdoors, some of the food can be placed there before it starts to thaw, but be sure it is placed where it is protected

from animals, both domestic and wild. In some areas of the flood-ravaged Northeast last year, freezer trucks were available where people could store food from powerless home freezers. In other parts of the country, commercial frozen-food lockers have been borrowed or rented during similar emergencies. Local police or Red Cross units can sometimes advise if these are available, once the initial emergency has passed but power lines are still down.

Many campers own small hand-carried gasoline-powered generators. These small powerhouses often pack 1100 to 1500 watts of power into a 60 to 100-pound package. They can be stowed easily in a car trunk or back of a station wagon and can be carried by one or two men. These portables can bring convenience and comfort to a campsite with little effort and cost, but if selected for suitable use during a home emergency as well, they can switch from pinch-hitter role to that of star performer.

A typical 1100-watt plant, 19 by 17 by 16 inches, may cost $150 and provide a great deal of camping satisfaction and emergency aid for the money. A typical freezer may use about 300 watts of power, a furnace fan 270, TV 300 and a radio 80. One burner of an electric stove can consume about 1250 watts, so you'd need either a bigger generator (1500 watts at about $200 weighing 75 pounds), or a smaller hot plate. An electric frying pan would not be a good substitute; many use about 1200 watts.

Care must be taken not to overload your generator. Most motors will draw from it an extra amount of power (surge current) when they start and could overload the generator even though your constant operation load current is within the unit's limits. One rule of thumb is to hook up appliances which use power equal to no more than 75 percent of the generator's maximum operating capacity.

Most appliances have wattage requirements stamped or embossed on them. Some carry only current ratings, but these can be converted into watts since wattage equals current (amperes) times voltage (120 volts). Many generators can be run on either gasoline or natural gas and have designs that make conversion simple for the camper or homeowner.

Another source of emergency electrical power is your car's generator or alternator. A temporary 12-volt automotive extension trouble lamp can be plugged into a car's cigaret-lighter socket, and several companies sell converters that will supply enough current to power lights, radios and small appliances. These converter kits, however, will not run the induction motors found in refrigerators, freezers, pump and furnace motors and other large appliances. But auxiliary alternators from many of these same companies, designed for use in addition to your car's standard alternator, can power induction motors. Since a car engine is not primarily intended for producing electricity, however, it will be less efficient than a small portable auxiliary 1100-watt generator that's priced only about twice as much as the auto modifications or additions and is much less expensive to run.

Many other camping items, of course, can become very useful indoors, especially if resumption of electrical power is delayed over several days. Candles, flashlights, water-purification equipment, first-aid gear, warm clothing, foul-weather gear and extra camp bedding will be put to excellent use if additional disaster victims must move in temporarily with you. With luck, the situation will be cleared up quickly, but the camper who has chosen his outdoor gear with a thought for indoor use as well will never regret it. ★★★

Generator wattage required

Add up items you use to determine approximate portable generator capacity you need.

APPLIANCE	AVERAGE POWER USED (WATTS)
Electric blanket	200
Broiler	1350
Coffeemaker	800-1100
Furnace fan	270
Oil burner	270
Water pump	340
Frying pan	1200
Hot plate	1250
Radio	80
Color television	325
Sump pump	400
Range (per element)	1250
Refrigerator/freezer	350-450
Freezer	300
Space heater	750-1500
Iron	900-1200
Water heater	1500
Light bulbs	Indicated on bulb

Stirrups for your spear gun

by Gene Cabot

Loading or reloading a spear gun should be done in the water, a chore which can be both difficult and painful with the butt pressed against your chest.

Letting leg action do the work is a big improvement that is easy with cross braces mounted as shown. Using soft do-it-yourself aluminum, cut and round upper and lower straps and bend to shape to fit gun shaft. Rivet or bolt the straps together with aluminum to prevent galvanic corrosion. Spray with zinc-chromate primer and paint with nonreflecting flat black. The stirrup also acts as a stabilizer when you aim the spear gun as you swim toward a target.



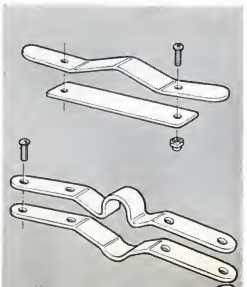
Leg push with flippers on the stirrups while you hold shock cord stretches elastic for easy cocking of gun in the water.

Single or twin-rubber guns are fitted with aluminum straps (below left) by bending to shape.

Straps (below center) can be partially shaped, then bent to final fit as bolts are tightened.

Removal of stirrup strap (below right), is simple when bolts are used instead of rivets.







IT'S NEW NOW



'Flying' house is full of suspense

One way to have a dry cellar and save on the cost of a foundation is to hang your house in space like this one. Designed by Italian architect Lorenza Papi of Florence, the unusual structure is suspended on cables from an A-frame support. Should you want a change of scenery, it's easily disassembled and moved to a new location.



See-through carriage lets baby look out, mother look in

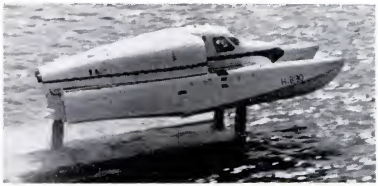
Infants get a better view of the world around them and their mothers a better view of them with this see-through baby carriage. The transparent canopy eliminates the dark, closed-in effect of conventional carriages, believed by some to be psychologically bad for newborns. It also makes it easier for Mom to keep tabs on baby. Patterson Edwards, Ltd., Lee High Rd., London S.E.



Mechanical 'beachcomber' cleans English beaches

It looks something like a harvester, but the only crop it gathers is one of rusty beer cans, broken bottles and other debris left by summer beach-goers. Dubbed the "Beachcomber," the machine sifts the sand and scoops out trash on British shores. Holywell, Newcastle-upon-Tyne.





New fast French hydrofoil

Skimming along at speeds up to 106 mph, the 3.7-ton hydrofoil above is a "small" test prototype for much larger craft to come weighing 140 to 150 tons. It's powered by two airplane-type turbojet engines, each developing 1028 pounds of thrust. At low speeds (top), it planes on two sponson-like pontoon hulls. As speed increases, it climbs completely out of the water and rides on three foils (bottom). The high-speed craft is being developed by the French firm of Aerospatiale for fast coastal transportation.



Out of the minds of babes come real inventions

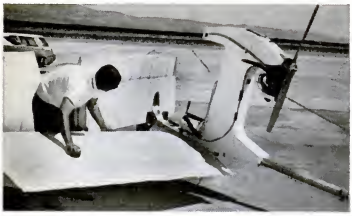
Inventing starts at an early age in England. At the Walkden County Secondary School in Worsley, pupils are encouraged to come up with new technological developments as part of their science classes. The program has proved so successful that more than a dozen inventions have already been patented and sold to manufacturers by the children. That above automatically alerts the blind when a glass is filled to safe level.



Truck trap catches brakeless runaways before they crash

What looks like an ordinary median strip between highway lanes is actually a trap. Filled with soft gravel, it's designed to catch and stop runaway trucks whose brakes have failed on long downgrades. It's located at the bottom of a steep mountain road near Los Angeles, the site of many past accidents.

NOW







World's lightest aircraft?

This build-it-yourself airplane weighs less than its pilot—only 120 pounds. Made of lightweight foamed-plastic panels with an aluminum-tube tail boom, it resembles an early Wright Brothers creation and, in fact, incorporates some of the same basic principles. In place of ailerons, it uses "wing warp" for roll control, just as the Wrights' did, and has "plug-in" wing spars borrowed from the World War I French Spad. Its pusher prop is powered by a 15-hp McCulloch kart engine, giving the ship a cruising speed of 50 mph. Though it's not officially established, designer Bob Hovey, an aerospace engineer, believes his flyweight is the world's lightest man-carrying, prop-powered aircraft. Plans are $10 from R.W. Hovey, Box 1074, Saugus, Calif. 91350.



Opaque marker for nonporous surfaces

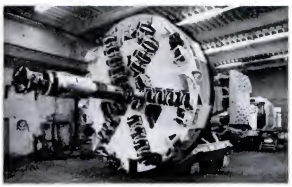
Micro-Marker II writes in opaque lacquer on metal, glass, plastic, rubber—any nonporous surface—with a metal fiber tip. Available with fine or broad tip in 11 colors: red, blue, black, white, orange, yellow, green, brown, violet, gray and light blue. Markers are $1.50 each postpaid from Easy-Mark, Inc., 39 Crosby St., Lowell, Mass. 01852.

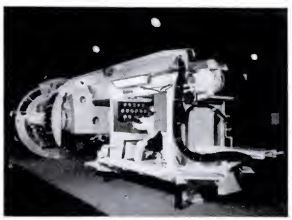


Fancy pliers in small sizes

Small but tough, these jeweler's pliers are nickel-plated, feature box joints—stronger than lap joints—and have vinyl-covered grips. Made of drop-forged tool steel, they are available with serrated jaws for firm grip or smooth jaws to avoid marring, in flat-nose, chain-nose, round-nose and looping styles; wire cutter matches pliers. Pliers are 5 to 6 in. long. For information, prices, write Brookstone Co., Peterborough, N.H. 03458.







'Mechanical moles' dig tunnels like a knife through butter

The days of sandhogs hacking their way through tunnels with jackhammers and hand shovels are gone. Now giant tunnel boring machines (TBMs) chew subway-size holes through the earth at the rate of more than 100 feet a day—10 times faster than the rate considered good not long ago. Huge hydraulic jacks push the TBMs along as whirling cutters slice through rock and clay. Some TBMs like Ingersoll-Rand's (middle photo above) have pilot drills that probe ahead for dangerous gas pockets, a major tunneling hazard in the past.



Soundless hovercraft for sneak attacks

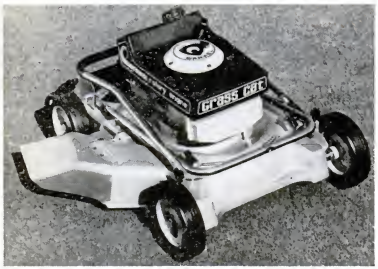
Carrying a crew of two and four soldiers, this amphibious hovercraft is the British Army's latest mechanized weapon for raiding and reconnaissance operations. In use, the go-anywhere Cushioncraft CC7 has a beam of 15 feet, but collapsible side decks enable it to be narrowed to half this width for easy road transport. It's the first air-cushion vehicle to feature virtually noiseless operation, making it ideal for quiet sneak attacks.



Flying Pinto sprouts wings

One of these days you may be able to drive your car to a nearby airport, put on a pair of wings, fly to a distant city, then park the wings and drive on into town. That's the idea behind the AVE Mizar flying car shown above undergoing FAA certification tests at Point Mugu, Calif. The hybrid consists of the wings, engine and airframe from a Cessna Skymaster mated to a modified Ford Pinto. The conversion from car to plane is said to take only two minutes and you're on your way. In flight, a pusher-type prop powers the "rent-a-wing" car.

NOW



Rotary engine enters yard-maintenance field

Follow the Wankel trend with a rotary-engined walk-behind lawnmower. Manufacturer, Arctic Enterprises, Inc., Thief River Falls, Minn. 56701, says its Grass Cat's 4-hp, German-made rotary Wankel plant cuts noise and vibration, while its increased torque range boosts cutting power. Mower's sticker price: $159.95. Company is also considering the rotary engine for self-propelled mower and tractor applications.





Decorative heater is cooler, safer

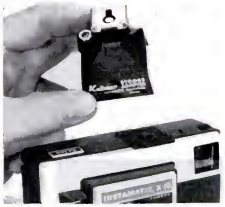
Hearthstone portable plug-in heater boasts efficient, economical radiant heating at safe, low temperatures, features thermostatic control with temperature adjustment. With decorative, baked-on harbor scene or ember-red surface, unit is $69; with sailboat blueprint design, $79. Sold in department stores. Infra-Red Circuits and Controls Corp., 215B Central Ave., Farmingdale, N.Y. 11735.





Now skin prints are fingering criminals

Until now, fingerprints left on a crime victim's body have been difficult to detect because, unlike those on wood or metal surfaces, they are not visible to the eye or a conventional camera. Now two Scottish radiologists have developed a new technique in which the victim's skin is dusted with a metallic powder, then X-rayed. Metal particles adhering to skin show up as patterns duplicating attacker's prints. The method was devised by Daniel Graham and John Thompson working with Glasgow police.









Take your choice—strobe or flashcube: Now you can switch-shoot with either

Want to shoot strobe flash with a nonstrobe camera or flashcubes with a noncube camera? You can do either with these clever adapters, and both have their advantages. Strobe flash saves the cost of cubes, but offers a limited number of shots per charge. By switching over to cubes, you can keep right on shooting after a strobe has petered out. The adapter at far left fits a small strobe to X-type Instamatic cameras, snapping into the flashcube socket. The adapter at near left lets you use flashcubes with any camera having a shoe mount and strobe sync. Both sell for about $10 each at photo shops and discount centers. Kalimar, Inc., 2644 Michigan Ave., St. Louis, Mo.

From snowmobile to 'boat-mobile'

You don't have to wait until the snow flies to use your snowmobile with the conversion rig below. Just put on a pair of pontoons and you have a speedy little water craft capable of hitting up to 25 mph. The experimental rig, not yet on sale, is being developed by Massey-Ferguson, Des Moines, Iowa.





Economy blowtorch

Ideal for wide variety of household chores, UL 100 blowtorch is said by maker to be the only UL-listed torch in its price range, features solid-brass burner, clog-proof filter. Suggested price is $6.95. Bernz-O-matic Corp., Driving Park Ave., Rochester, N.Y. 14613.



Handy headlight reminder

You can't forget to turn your car lights off when parking with this alarm to remind you. It buzzes whenever ignition is turned off with lights on. Only two simple connections to fuse-block clips are required. $5.95 postpaid from Yorkhouse, Box 1006, La Habra, Calif. 90631.

NOW







Sailboat with a split personality thinks it's two rowboats

This unusual come-apart sailboat knocks down into two-self-contained halves, each serving as a small rowboat (bottom photo, near left) when you're not sailing. The sections go together in 15 seconds to produce a hull about 15 feet long with a Marconi mainsail and Genoa jib (far left). Apart, the sections nest neatly together for compact storage and easy cartopping (top photo, near left). Boat is made by the Dutch firm of N. V. Jachtwerf in Volendam, Holland, sells abroad for about $800.



Wise solution for a problem stump

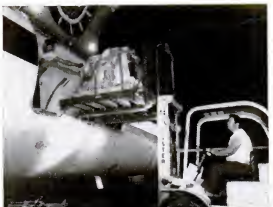
One way to handle a problem stump—turn it into a decorative lawn carving. That's what W. L. Husted of Cedar Rapids, Iowa, did. His wise old owl is the result of a few hours' work with chainsaw, truck reflectors for eyes, hardboard for a hat.

Fast help for cars in distress

Pull the handle on this emergency roadside call box, press any of four buttons—fire, police, ambulance or service—and help is on the way in seconds. Radio system by ADT, 155 Ave. of Americas, New York, N.Y.







Ford flies car parts to get them to you faster

Called the "Midnight Special," a big DC-9 is readied for takeoff in the dark of night, its cargo automotive replacement parts. The plane leaves Detroit every evening in a new service to speed parts to Ford auto dealers all over the country.





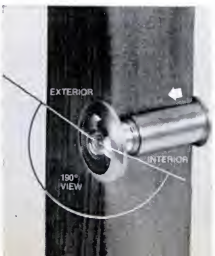
Would you believe a supersonic jet that can land on a dime?

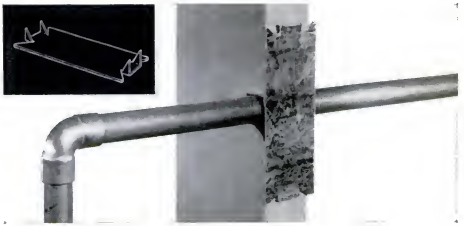
Cross a helicopter with a supersonic jet and you have this versatile new British-designed Harrier fighter soon to join the U.S. Marine Corps. Swiveling jets permit either vertical or forward flight. The droop-winged craft can climb 40,000 feet in less than 2½ minutes and hit speeds of Mach 1.25.

Door viewer offers protection through wide, wide angle

Unwelcome company will have no place to hide when you survey your doorstep with this $5.95 viewer. Its optical glass (not plastic) lenses give a 190° field of view. Installed in doors up to 2⅛ in. thick by drilling one hole, viewer is available in brass or chrome. At hardware stores or from Loxem Manufacturing Corp., Box 47307, Dallas, Tex. 75247.







Hammer-in strips protect pipes, cable

"Idiot strips" protect pipes and electrical conduit running through wall studs from being accidentally punctured when you drill holes or drive nails into walls. The metal strips, about 10 cents each, are sold through building supply dealers. Modern Metals, Inc., 1311 Ashland St., Houston, Tex. 77008.

Flashing lights to lull you to sleep

The old four-poster goes modern with this overhead psychedelic light display. Designed by New York artist Earl Reiback, it produces ever-changing patterns of light and color, is said to induce sleep in insomnia sufferers. But the price may keep you awake: $8500.



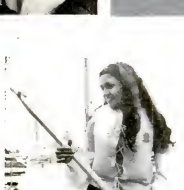
NOW





Take a trip with a tour guide on tape

You don't need a guide along when you go on a driving tour with a "robot guide" on tape. Available for most U.S. national parks, the cassettes describe passing scenery, rent for $5, including tape player, from travel and car-rental agencies. Comprehensive Communications, 565 Fifth Ave., New York, N.Y. 10017, developed the idea.



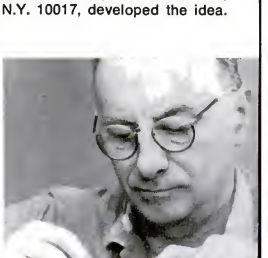


Boat hook grows from short to long

Boat hooks are handy when you need a long reach, but are awkward to stow aboard small craft. Now a British firm has a telescoping version that collapses from 8 feet to only 3½ feet. Channel Marine, Ltd., 49 Harbour Parade Bus Station, Ramsgate, Kent, England, is the maker.

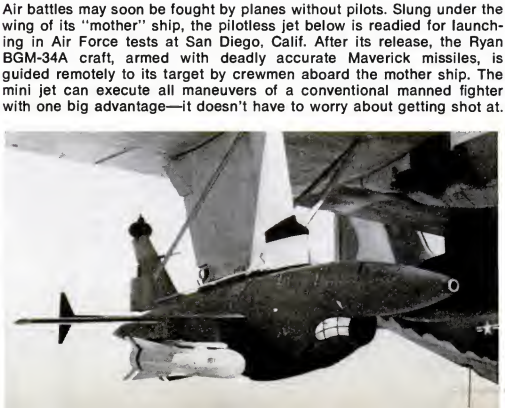
World's smallest live-steamer

What is believed to be the world's smallest operating live-steam locomotive is shown at right—the product of 2000 hours of work by Arthur Sherwood, an engineering professor at the University of Sydney, Australia. Built on a scale of 1/240, it's less than 4½ inches long and actually runs on steam generated by a tiny butane burner. But it's big compared to Sherwood's electric models—they're on a 1/480 scale and are half the size!



Pilotless jets for fighting robot wars

Air battles may soon be fought by planes without pilots. Slung under the wing of its "mother" ship, the pilotless jet below is readied for launching in Air Force tests at San Diego, Calif. After its release, the Ryan BGM-34A craft, armed with deadly accurate Maverick missiles, is guided remotely to its target by crewmen aboard the mother ship. The mini jet can execute all maneuvers of a conventional manned fighter with one big advantage—it doesn't have to worry about getting shot at.







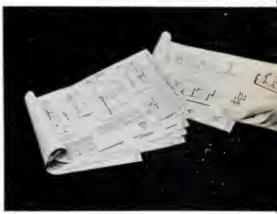


String-by-number

String art, long used in schools, has now been packaged in kit form for fun at home. String wound around small nails tacked in boards produces striking three-dimensional "pictures" like the animals and sailboats above. Kits, for $6 or $12, include string, nails, patterns, boards, instructions from Atech Enterprises, Inc., 1326 New York Ave., Huntington Station, N.Y. 11746.

Help with home wiring, plumbing

These large-scale sets of diagrams, prepared by professionals, take you step-by-step through all aspects of residential plumbing and wiring. Each set is $5. From Home Building Plan Service, Dept. PM, 2235 N.E. Sandy Blvd., Portland, Ore. 97232.





Mechanical baby sitter: Modern substitute for Mom

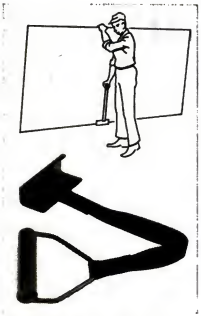
Busy mothers might welcome this mechanical baby sitter developed by German designers Gunter and Iri Beltzig of Deimhausen. A sort of combination baby carriage and playpen, the futuristic device serves as both a bed for infants at nap time and a play area to keep them safely occupied when awake. Incorporated in the automated center is a motor-driven rocker, regulated bottle warmer, programmed snack dispenser, timed sun lamp, taped music for entertainment and a variety of toys to play with. Apparently the only thing missing is an automatic diaper-changer—the designers haven't figured that out yet.



Well, they beat walking, traffic, fuel shortages

Powered by an old lawnmower engine, these motorized roller skates hit speeds up to 20 mph and get 145 miles to the gallon. They're the brainchild of 75-year-old Tommy Hancocks of Beaconsfield, England, who figures they're just the thing for beating both traffic jams and fuel shortages. Throttle and clutch are controlled by bending the knees, leaving the hands free.

NOW



Handy panel carrier

Plywood toter makes awkward 4x8 panels easy to carry. Pocketable nylon-belt or all-steel model sells for $4.95 at building supply and hardware stores, or from Metaltek, Inc., Box 30388, Raleigh, N.C. 27612.







Picture-taking rocket

Ever wish you could photograph the flight of a model rocket from the rocket itself? Sounds impossible, but now there's a battery-powered Super-8 movie camera to fit a toy rocket. Middle photo shows rocket's eye view of parking lot below, while lower photo shows chute deploying for recovery. Camera, about $20, was developed by Estes Industries, Box 227, Penrose, Colo. 81240.



Mini one-man diving bell

Sealed inside a watertight capsule, an engineer is lowered over the side of a ship to inspect the underside of the hull. Developed by the Navy, the plastic-sided capsule provides greater visibility and comfort than are possible through use of divers.



Electric trucks are back

Remember those old electric trucks you used to see in some U.S. cities? They're back again—at least in Britain. Battery-powered garbage truck above is one of several being tried in Manchester, England, to provide quiet fume-free operation. Maker is Crompton Leyland Electricars.



Special saw for laminates

This double-edged saw for laminates, plywood, veneers and plastic pipe has extra teeth on the back of the curved tip for making internal starting cuts. The 12½-in.-long Swedish-steel blade has 14 points to the inch, can also be used in a miterbox. No. 314 Laminate Saw is $4.45 at hardware and building-supply dealers. Sandvik Steel Inc., 1702 Nevins Rd., Fair Lawn, N.J. 17410, makes it.





Big jumps on tiny trampolines

You need a sure eye and quick reflexes to hit the mark on these mini trampolines. Only 28 inches in diameter, they're designed to fit in spaces too small to permit conventional-size trampolines. They're also said to sharpen gymnastic skills due to the added coordination needed. Maker is Textil & Kunststoffverarbeitung, Box 93, D 5812 Herbede, Germany.



New refrigerator requires less electricity

Consumption of 30 to 50 percent less electricity than competitive models is claimed for Philco-Ford's new frost-free refrigerator design. Liner molded from single piece of plastic allows more efficient use of insulation and heating elements, fewer parts, less chance of leaks. Unit is decorated to taste with changeable front panels.



One-lunger in kit form

This 3.5-hp, one-cylinder air-cooled gasoline engine comes in a kit you can put together with simple hand tools, has a variety of applications. $59.95 from Clinton Engines Corp., Maquoketa, Iowa 52060.

Monster hauler rolls on 80 wheels

Looking like a giant mechanical centipede, this mammoth flatbed hauler rides on 20 sets of four-wheeled axles or a total of 80 tires. Made for carrying large industrial equipment, it's more than 70 feet long and 22 feet wide. It can tote loads up to 620 tons and itself weighs 920 tons. Top speed is a slow crawl—about 3 mph. Mitsubishi Heavy Industrial Co. of Japan is the carrier's maker.



Car stereo speakers: How to install them



PHOTO BY THE AUTHOR

by Eugene Walters

You don't have to have a pro install your car speakers to get a professional-looking job like the one above. But it pays to do it like the pros do.

First, decide where you want your speakers. Rear-deck speakers are often easiest to install, since many U.S. cars already have the necessary holes. But front mounts —in the doors or front kick panels—give you the best stereo effect in the front seat. And that's the seat most likely to be occupied.

Probably the hardest part of mounting speakers in a door is finding a spot where they won't interfere with structural members or the window mechanism and at the same time won't be placed where the seats will swallow up their sound. Pros (like the ones at Wally's Tape City in New York, where the pictures on the facing page were taken) know these spots, but you'll have to find them. Loosen the door trim panel, and check out possible speaker sites as you raise and lower the window. Then measure carefully and cut your hole. Use a sabre saw or hacksaw, or drill a circular pattern of holes and saw from one hole to the next. But don't use a power drill or saw on carpet-covered doors—the carpet may tear or run.

To run the speaker wires, remove the inner kick-plate trim (just in front of the door) and drill holes opposite each other in the door edge and door pillar. Line the holes with grommets, so their edges won't cut the insulation. Run wire through the holes to the speakers, and solder them so



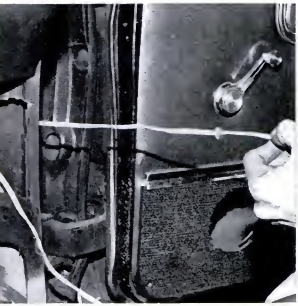
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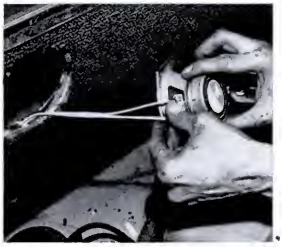


4



5

After opening inside door panel to find suitable speaker location, measure distance on panel (1), mark punch and drill mounting holes (2), and cut speaker hole (3). Remove car's inner kick-plate panel (4), drill kick panel and door edge, then thread wire (4 and 5); note grommets in holes. Run leads to speaker (6) and solder; be sure positive wire goes to same terminal of each speaker. Position speaker, align screw holes (7), mount speaker and grille (8). Use self-tapping screws if door is metal, speed nuts or washers and lockwashers if fiber. Grille here matches car interior, but chrome finish shown on facing page resists scuffs best.



6



7



8

PHOTOS BY IVAN BERGER

Rear-deck speakers are easy to install





Rear-deck mounting is simplified in many cars by holes precut for 6x9-in. speakers. If you have to cut your own hole, you can reduce the amount of hacksaw work needed (upper right) by drilling holes around the speaker periphery, then hacksawing between them. Slanting rear windows on most cars prevent use of sabre saws. Wiring inconspicuously is easier If you unscrew the door saddle (upper left), clear out pebbles or debris that could cut wires, then run wire under saddle. Grille cloth can keep holes in metal grille from focusing sun's burning rays on speaker. Cut to fit the speaker (right), then apply under the grille (lower right). Avoid plastic grilles on rear-deck speakers; they tend to warp or melt.





PHOTOS BY THE AUTHOR AND IVAN BERGER

they can't vibrate loose. Make sure the "hot" leads from each channel of your tape deck go to the same terminal on each speaker, or you'll lose bass response.

For rear-seat speakers, snake the wires unobtrusively through the car by tucking them under the edge of the carpet or floor mats. Where the wires pass the doors, run them under the door saddle (first removing the saddle to clear away gravel or debris that might cut the wires).

To get the wires into the trunk, you must usually remove the rear seat cushion, which is easy. But getting it locked back in again is usually a two-man job. The holes that pass the wire into the trunk should also be grommeted to prevent chafing; it's not a bad idea to caulk the space around the wires, too, against the possibility of exhaust-fume leaks.

Wedge-type, surface-mounting speakers are easiest to mount on the rear shelf, requiring only screw holes for attachment and

(Please turn to page 191)

Car stereo speakers: How to pick them

Specifications don't tell the story— but your ears can.

by Ivan Berger
ELECTRONICS EDITOR

PHOTOS BY PETER SCHNEIDER

Picking the right high-fidelity speakers for your home is hard. But picking speakers for your car stereo is even harder—at least, if you really want to get the best possible sound.

Specifications tell you little about how a speaker sounds, and you can seldom hear car speakers demonstrated—almost never in a car, where the sound differs from that in a showroom.

Still, there are some listening tests you can make, though not all of the tests you'd use in picking speakers for the car's good (but difficult) acoustical environment are the same ones you'd use in picking speakers for your home.

High frequencies, for instance, needn't extend as high for car speakers as they should for home hi-fi; the car's upholstery absorbs most of the upper frequencies, and highway noise will mask the rest. (Nonetheless, most of the speakers we checked had substantial, if irregular, response above 13,000 Hz.) Because of these high-frequency losses, car speakers should sound a little "brighter" than home speakers do. But avoid speakers that sound shrill, a sign of high-frequency peaking and distortion.

Since car speakers usually face your knees, your elbows, or the back of your head, good dispersion of what highs there are becomes even more important than at home—especially since the highs won't bounce as they do in normal rooms. A hissy, unrecorded section of a tape, or noise between FM stations, makes a good test: Check to see if the tone of the hiss changes much when you walk past the speaker. The more



Car speakers of many types are shown here with PM's test gear.

Basic specifications of 19 car stereo speakers

SPEAKER	PRICE PER PAIR	NOMINAL CONE SIZE	IMPEDANCE (OHMS)	RELATIVE EFFICIENCY[1]	RATED FREQUENCY RESPONSE	MAGNET WEIGHT	GRILLE	POWER-HANDLING CAPACITY	REMARKS
Afs Kar Kriket	$40	5″	8	—3 db.	65-17,000 Hz.	10 oz.	Cloth	10-w. RMS, 18-w. peak	In large wedge enclosure, choice of colors
Altec 405A	30	4″	8	—4 db.	60-15,000 Hz.	28 oz.	None	10 w.	
Dynamite Sound ST-112	17.50	5¼″	8	—5 db.	50-10,500 Hz.	12 oz.	Padded	10 w.	
GC Audiotex 30-3004	12	5″	8	—4 db.	NA	3 oz.	Chrome	5 w.	
GC Audiotex 30-3010	13	5″	8	—1 db.	NA	3 oz.	Aluminum	5 w.	In plastic mount for surface or under-dash mounting
Heath CRA-1000-2	20	5″	4	—4 db.	60-15,000 Hz.	9.8 oz.	Plastic	10 w.	With adapter plates for 6x9″ openings
Heath CRA-1000-5	20	6x9″	4	+2 db.	40-15,000 Hz.	10 oz.	Metal	10 w.	
Jensen SK96RRFX	50	6x9″	8	0 db.	40-16,000 Hz.	20 oz.	Plastic	25 w.	
Jensen SK525FX	40	5¼″	8	—3 db.	55-13,000 Hz.	10 oz.	Padded	25 w.	
Philco-Ford	24.60	6x9″	3.2	—7 db.	NA	2 oz.	Metal	NA	Supplied with Philco-Ford car radios
Philco-Ford	24.60	5¼″	3.2	+1½ db.	NA	3 oz.	Metal	NA	Supplied with Philco-Ford car radios
Pioneer TS-52	60	6″ woofer, 2″ tweeter	4	—2½ db. (—4 db.)[2]	70-12,000 Hz.	6.8 oz. (woofer)	Plastic	8 w., 16-w. peak	Ultraversatile mount, swiveling tweeter
Poly-Planar	20	6x10″	8	—4 db.	60-20,000 Hz.	NA	Plastic	NA	All-plastic, flat rectangular "cone"
Realistic 12-1845	20	5¼″	8	—1½ db.	NA	8 oz.	Padded	5 w.	
Realistic 12-1846	20	5″	8	—4 db.	50-16,000 Hz.	32 oz.	Rubber	12 w.	
Toshiba TCS-10	30	5″	4	—1 db. (—2 db.)[3]	NA	NA	Plastic	5 w.	
Trusonic 50FR	30	5″	8	—3 db.	50-18,000 Hz.	32 oz.	Chrome	12 w.	
Wally's 5-inch	20	5″	8	—4 db.	NA	6 oz.	Metal	5 w., 16-w. max.	
Wally's 6x9	40	6x9″	8	—2 db.	NA	14 oz.	Metal	10 w.	

Notes: [1]See text. [2]Measured with speaker panel surface-mounted in simulated car trunk to improve base response. [3]Measured with enclosure mounted over 5″ hole in simulated car trunk. NA-Not available.

even the sound, the better the dispersion.

Low-frequency response will probably be better in the car than in the showroom, since the car's interior is too small for standing waves to create bass peaks and dead spots, and too oddly shaped for resonances to overemphasize some frequencies. Most car speakers will deliver more bass when mounted in a door (and still more when mounted in the parcel shelf above a car trunk) than they can in the small boxes usually used for demonstration enclosures. And though "wedge" speakers designed for mounting on rear decks (or in station wagons) have built-in enclosures, their bass response can be increased by mounting open-bottom wedges over large holes leading to the trunk, or removing their speakers for surface mounting in a trunk shelf or door panel.

Make sure whatever bass you do hear is clean, not thumping muddily away like a juke box. A male announcer's voice on FM should sound natural on a good speaker, not as if he were speaking from the bottom of a barrel. Boomy, resonant bass may sound more spectacular than the real thing (especially on rock), but it muddies up the music, makes announcements and song lyrics (already difficult to hear on a noisy highway) unintelligible, and eventually gets very tiring to listen to.

It's especially important that car speakers sound clear at high sound levels, since high volume is often needed to overcome road, wind and motor noise. If you can, compare speakers to see which can play loudest before they sound distorted to you—distortion is always tiring to hear, and you don't need extra sources of fatigue while driving. If possible, for this test drive the speakers with the same tape unit you're buying, or one with about the same power and impedance ratings—it matters little how clean your speakers sound if your tape player can't drive them without distorting.

Since car radios and tape units have only limited power, speaker efficiency is important. Typical in-store demonstrators let you switch from one speaker to another. The louder the speaker, the more efficient it is. But don't give this figure too much weight: of the 19 speakers we checked, seven were identical in efficiency, and 12 were within one db. of one another (three db. is about the smallest easily detectible difference).

Take manufacturers' frequency response ratings with a grain of salt. Sure, every speaker will deliver some sound at every frequency within its rated range, but the ratings don't say whether the lowest and highest rated frequencies are 3 db. or 23 db. softer than the mid-frequencies, or how even the sound may be between those limits. And take magnet weight as only the very roughest indication of how good a speaker is—manufacturers seem to be developing a horsepower race here. ★★★





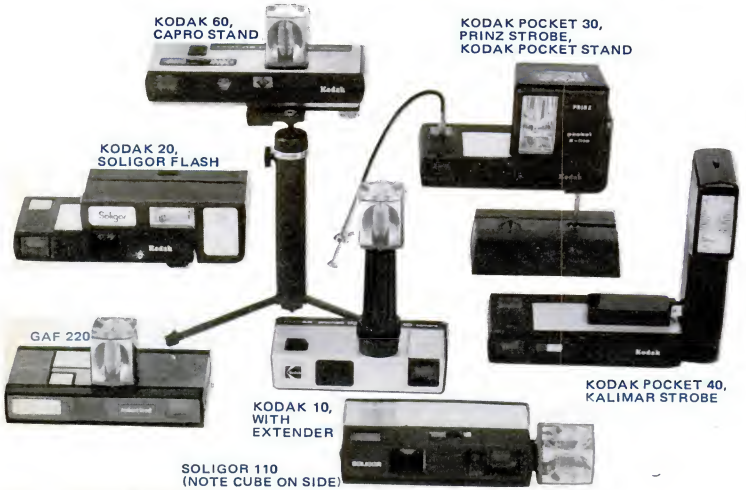
Test setup (left) used for speaker efficiency and frequency response checks included imitation "car trunk" used as speaker enclosure and a battery of instruments. Pioneer (above) had aimable tweeter, bass reflex woofer, could be mounted permanently or for easy removal.

Pocket cameras become big business

by Ivan Berger
PHOTOGRAPHY EDITOR

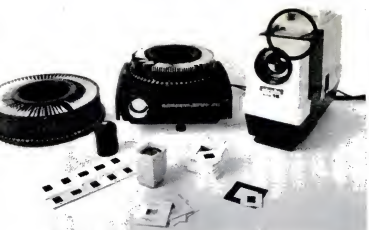
Kodak's Pocket Instamatics are catching hold even quicker than the original Instamatics did. Neither the first nor the smallest subminiature cameras, they are the first for which you can find film in any drugstore. And now a host of 110-size cameras and accessories from other companies are helping to swell the boom. Most of the new cameras are simple ones, but more sophisticated models are coming from Argus and Yashica, probably from Rollei and Minolta (already manufacturers of subminiature cameras) and possibly from Konica as well.

"Redeye" flash reflections are a problem with flash mounted close to the lens, so Kodak now packs a Magicube extender with every Pocket Instamatic, and offers one free to older Pocket Instamatic owners; for other camera owners, the price is now reduced to $1.50. Electronic flash units cut the cost per shot for heavy flash users, but, with the exception of the Kalimar, don't

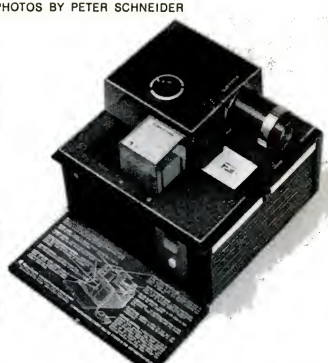


Kodak still makes most 110 cameras, but not all of them. Clockwise from upper right: Kodak Pocket 30 with Prinz flash (on Kodak Pocket stand), Kodak Pocket 40 with Kalimar flash, Soligor 110 (with Magicube on side), GAF 220, Kodak 20 with Soligor flash, Kodak 60 on Capro stand. Center: new Kodak 10, shown with flash extender now included with all Kodak 110s, free to older Kodak 110 owners.

PHOTOS BY PETER SCHNEIDER







Pocket Instamatic shots are at their best as slides. At top left: Kodak's Pocket Carousel (center), next to standard Carousel tray for size comparison; D&L 33-mm lens in front of tray; in foreground, Capro viewer, Kodak and Hanimex 2x2 slide adapters, Berkey 2x2 mounts; right, Minolta 16 projector for 2x2 mounts, with slide previewer (circled). At left, Argus 2110 Pocket Slide Theater. Above: Bell & Howell Slide Cube projector with short-focus lens for 110 projection.

help with redeye. The built-in strobe on Keystone's new 110 Everflash doesn't either, but the side-mounted flashcube on the Soligor 110, two inches farther from the lens than top-mounted cubes, does.

Kodak's Pocket Carousel for 30x30-mm-mount 110 slides is being joined by an Argus table-viewer/projector combination, with some Hanimex projectors in the offing. Capro now has a pocket slide viewer that takes 110 slides still mounted on the "stick" as Kodak returns them. Other processors, and now Kodak, too, will also return 110 slides in standard 2x2-inch mounts for use in regular slide projectors; but to get a full-size image, you'll need to change your slide projector's lens.

Most useful of accessories I've tried is Kodak's new Pocket Instamatic Clip (like most electronic flashguns, it doesn't seem to fit non-Kodak 110 cameras too well). It's cheap, effective camera insurance. For better, if bulkier, protection, cases are now available in plastic or vinyl from Kodak, Casemakers, Service and others. ★★★



Cases protect cameras; clips keep them in your pocket (top). Case at left in upper shot and clip on camera at center are from Kodak. Others (including two-piece model with detachable film and Magicube case) are by Casemakers. Tanks and reels (lower photo) were here for 110 before cameras were, since 110 film is 16 mm wide. Shown from left to right are Honeywell, Nikor, Jobo and Kinderman.

Shredders, grinders, chippers

They make mulch, compost and new soil.

by Gerald Kratsch

The grass clippings or leaves you discard this season can enrich your soil next year. You can put garden residue to good use—and eliminate a disposal problem at the same time—with one of the shredders, grinders or chippers now available. Some of them can reduce debris volume by a ratio of 15 to 1.

Fine shredding helps speed the decomposition of materials in a compost pile. Coarser chopping produces good mulches. With a chipper, branches can be turned into chips for use as ground cover. These machines are especially useful for the organic gardener.

Here and on the next three pages is a brief look at some units now on the market.



Shredder-bagger: designed for light-duty work

This is the most common type of shredder, the simplest in design and the lowest in cost. It uses high-speed rotary blades that are similar to the cutter on a rotary mower. Blade velocity creates a discharge of air that propels the shredder material into a plastic or cloth bag, or blows it into a pile. (A variation on the basic design uses a hammer-type rotor that beats material into small pieces.) The shredder-bagger processes newly fallen leaves (no decayed leaves, compost or other decayed material), twigs and branches that are up to approximately half an inch in diameter, as well as dried stalks and small vines. These units are powered by gasoline engines of 5 hp or under. Their prices are in the range of $140 to $195.



Brush chipper: for heavy work

Most chippers have two revolving blades that turn at high speed and cut against a fixed blade. Except for differences in size and cost, they work just like larger machines used by professionals to process whole trees. Compact garden chippers are designed for branches as large as 2 inches, for heavy shrub trimmings and stems. They turn the material into very fine, compact particles. They are not designed to process compost, soil, manure, large quantities of leaves or grass clippings. Chippers are powered by gas engines that range from 4 to 10 hp and are priced from $360 to $660.



Grinder: more versatile than rotary

The shredder-grinder uses a high-speed hammermill rotor—a series of "hammers" mounted on a shaft or drum—that grinds against a grid, reducing the material to a size that allows its passage through the holes of the grid. Since only a little air discharge is developed, the grinder cannot be used for power bagging. Processed material is discharged onto the ground or into a container. This machine does all the work of the rotary plus processing topsoil, clay, dried manure, branches slightly larger than half an inch in diameter. Grinders have engines of from 2 to 7 hp; prices range from $180 to $500.



Kemp shredder: the inside story

In this shredder-bagger, the shredding drum (1) and the teeth or hammers (2) rotate in a clockwise direction. Material is forced at high speed against a baffle plate (3), where most of the shredding takes place. If material is not shredded sufficiently to allow it to fall through the screen (4), it is carried around again for more shredding action. Some additional shredding of soft material takes place against the surface of the screen, where hard material such as phosphate rock also is ground. The baffle (3) keeps material in contact with the specially hardened shredding teeth.



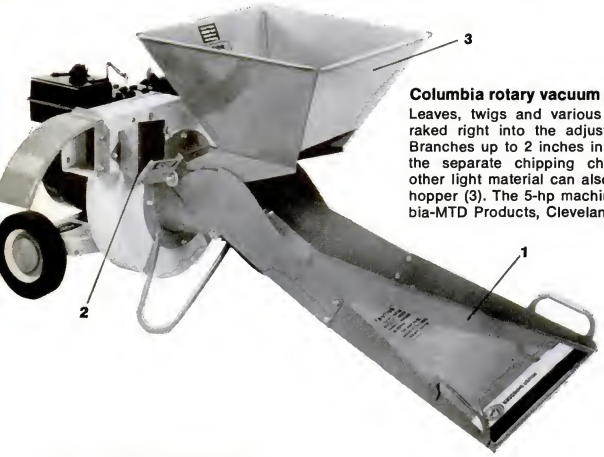
A 5-hp 'composter' from Allis-Chalmers

Powered by a Briggs & Stratton engine, this machine shreds and grinds leaves, clippings and heavier material such as twigs and small branches into fine particles ready for the compost pile. Three hammermill-type blades are fed from hopper; particles discharge from bottom gate.



Bolens 6-hp mulcher-bagger

Six reversible cutting knives chop leaves, grass clippings, sticks, vines, tree prunings, hedge trimmings and other garden wastes into mulch. A mulch helps control soil temperature; protects soil from sun in hot weather, and slows the cooling process when the mercury begins to drop.



Columbia rotary vacuum shredder-bagger

Leaves, twigs and various other debris can be raked right into the adjustable drop chute (1). Branches up to 2 inches in diameter are fed into the separate chipping chute (2). Leaves and other light material can also be poured into wide hopper (3). The 5-hp machine is made by Columbia-MTD Products, Cleveland.



Shredder attachment for Gilson tractor

Owners of "S" series tractors can add this front-mounted shredder, driven by the tractor's PTO (power take-off). There is a 15-inch clearance above the ground to permit direct discharge into container. The unit handles larger branches, root clumps and other coarse garden wastes.

A shredder and chipper in one package

Another machine for making little ones out of big ones is Billy Goat Industries' Chippit. It has two hoppers—one for shredding leaves and vines, the other for chipping branches. Both can be fed at the same time. A 5-hp model processes 2-inch branches, and the 8-hp Chippit handles 3-inchers. ★★★



How to select a modern scattergun

Shot shooters can select from a fine new assortment for skeet, trap and game.

by Gary Gillespie

In a country once described as a "nation of riflemen," the shotgun has become America's most widely used and versatile hunting and target tool. True, the rifle remains king for certain types of long-range accuracy, particularly for big game. But in all-around use, the scattergun now ranks first across fields and forests, trap and skeet ranges. As proof of this popularity, there now exists a wide variety of shotgun models, actions, gauges and prices.

To anyone in the market for the latest in smoothbores, this presents a problem and an opportunity. It is difficult to choose from so many options, but there is also a better chance to find a shotgun particularly suited to your activities.

□ *Single shot* is usually the lowest priced action, except for expensive trapshooting models. With simple "break-open" design, it is a popular beginner's gun, particularly in "youth" versions with short stocks. Due



Over and unders, like new Browning Liege (above and at top), permit barrels with different chokes, open and tight, on same gun.



Upland gunners prefer a light, fast-handling model, often 20 gauge, for short-range work such as quail hunting in Southwest.

to its limiting one-shot feature, however, it is a poor long-term choice for serious hunting. Price range: $30 to about $55.

☐ *Pump action* is a feature of America's basic "bread and butter" shotgun. Its rugged dependable action requires little maintenance. For varied types of shooting, look for models permitting interchangeable barrels with different chokes. These can give you, in effect, three shotguns for about 50 percent more than the cost of just one. Price range: $100 to $230.

☐ *Semiautomatic* is usually called "automatic" or "autoloader." This gun reloads automatically each time you pull the trigger and fire. Automatics are more expensive than pump actions and require more frequent cleaning and maintenance. They are appropriate for all types of hunting and highly versatile when the barrels are interchangeable. They excel for the fast shooting encountered in skeet doubles and such sports as quail and dove hunting. Gas-operated models are lighter in recoil—a worthwhile factor for both youngsters and ladies. Price range: $145 to $270.

☐ *Bolt-action shotguns* are repeating models that use the familiar rifle-type action. Usually they lack the "feel" and swinging qualities of more common shotgun actions for serious hunting, but can be good, low-priced utility guns for occasional use on garden pests and the like. Price range: $35 to $70.

☐ *Over-and-under double barrel* models have been growing in popularity recently but generally are the highest priced type of action. Two barrels, positioned one atop the other, permit two chokes on the same gun—open for the first shot and tighter for the second. The over and under is ideal for hunting upland birds such as grouse and pheasant. Price range: $200 to $1300.

☐ *Side-by-side double barrel* has the two barrels positioned horizontally. Advantages



Browning Liege, with newly popular over-and-under barrels, is example of high-quality economy at $473. It's available in 12 gauge only with all field chokes.

Fully-equipped waterfowl hunter can use 20 gauge over decoys; should pass shoot with 12 or 20 magnum.




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Sears extensive gun line, all tested by Ted Williams, includes this low-recoil auto. New over/under magnum 12 is priced under $200.

are similar to those of over and unders, but these are often lighter and faster handling. For budget buys, look for two-trigger models without automatic ejectors. Price range: $110 to $325.

□ *Choke selection* determines the degree of narrowing or constriction at the muzzle or outer end of the barrel. Open chokes such as "skeet" or "improved cylinder" let pellet pattern spread quickly for close shots within 30 yards or less. These open chokes are best for game in close cover. Select intermediate or "modified" choke if your shooting is varied

(Please turn to page 188)

1. Savage 333, new over and under in 12 or 20 gauge, has ventilated rib, auto ejector, interchangeable barrels, $274.

2. Winchester new single-shot, Model 37A, comes in 12, 16, 20, 28, 410 gauges; has shorter stock for 410, 20. From $47.

3. High Standard Supermatic gas-operated autoloaders have 26, 27, 28 or 30-inch barrels; at $160 up, 12 or 20 gauge.

4. Mossberg Model 500 pump, $107 up, is in 12, 16, 20 gauges. Pederson Custom Guns will feature fitting, import actions.

5. Marlin 120 Magnum 12-gauge pump has 3-inch or standard shells. $230 trap 120 has Monte Carlo stock, 30-inch barrel.

6. Remington's new 3200 is modernized version of famous Model 32. O/U 12-gauge field, trap, skeet models, $450 up.

7. Harrington & Richards Model 158 is a single-shot gun that is available in 12, 16, 20 and 410 gauges. Price: $41.95.

8. Ithaca Gun's new double-barrel Model 280 side-by-side in 12 and 20 gauge has traditional English-style stock, $305.

9. Beretta GR-2 from Garcia is a classic side-by-side double in 12 or magnum 20 gauge with double triggers; about $300.

Grade crossings take a deadly toll

Inadequate warning systems and driver negligence add up to 1400 deaths a year. Now new safety measures are under study.

by Jack Harrison Pollack



A tragedy at Congers, N.Y., provided the impetus for the development of the Solitron system, which uses radio waves to activate a warning device in a motor vehicle near crossing. Photo shows front section of school bus, sliced in half by freight train.



TRAIN HITS SCHOOL BUS . . . 5 KILLED IN GRADE-CROSSING WRECK . . . FAMILY WIPED OUT IN RAIL-HIGHWAY CRASH.

Headlines may vary, but the story is essentially the same: Each year approximately 1400 persons are killed and 1000 injured in 12,000 accidents at the more than 200,000 public grade crossings in the United States.

Four out of five of these crossings are protected only by passive devices such as the



ROY GRINNELL

familiar crossbuck (X) sign, according to the U.S. Department of Transportation. A study by the DOT found that 30,000 grade crossings warranted immediate improvement. Yet only about 1300 receive automatic protective devices each year.

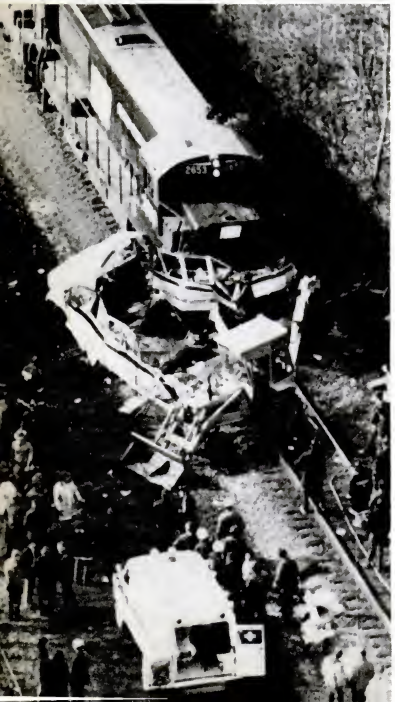
Even at many "protected" crossings, lights flash and gates come down long before a train arrives—if, in fact, a train does.

Countless drivers cross tracks day after day without seeing a train, tending to make them less cautious. In time, even warning devices become part of the familiar scenery. This helps to explain why two out of three victims die at grade crossings within 25 miles of home. Two-thirds of fatal accidents occur in daylight and clear weather, and most frequently during the peak traffic period between 4:00 and 6:00 p.m.

The old "stop, look and listen" advice to

Primitive accidents in the space age





motorists is as antiquated as the sleepy 19th-century crossing watchman with his flag or swinging lantern. But it is still important. Though school (and public) buses are required to come to a full stop at most grade crossings, some drivers fail to do so.

That's what happened in March, 1972, at a grade crossing at Congers, a town about 25 miles northwest of New York City. Five high-school students were killed and 44 injured when their bus was hit by an 83-car freight train traveling at about 25 mph. The train ripped the bus in two—dragging one section for a quarter of a mile before coming to a stop. (A train may need as much as two miles to come to a stop.)

Witnesses said the driver failed to stop at the grade crossing and to open the bus door for a look down the tracks, as is required. The driver was ultimately convicted of negligent homicide.

The only protection at the Congers crossing was a warning sign. A railroad spokesman described the crossing as "private," meaning that the road is not a federal, state or town highway. Thus, there is no legal requirement that it have gates or flashing lights. After the accident, school buses were rerouted to another crossing equipped with automatic gates.

More than half of the nation's grade crossings are still "protected," as in the horse-and-buggy days, with the standard stationary crossbuck. It is utterly inadequate at the majority of crossings. The black-and-white sign is too often obscured by trees, shrubbery or billboards, located too close to the tracks or desperately in need of paint. At night you may not notice it at all, especially if it is not reflectorized. Is it any wonder, then, that almost two out of three grade-crossing accidents occur at crossings having only these signs?

New-type signs were recently installed at 204 public grade crossings along the 351-mile B&O Railroad mainline between Washington, D.C., and Parkersburg, W. Va. These signs say: "Look for Trains" and

Five students died and 44 were injured in the Congers crash. The 83-car freight pushed the forward section of bus a quarter of a mile before coming to a stop. Driver, convicted of negligent homicide, failed to stop at crossing.

"Railroad Signal Ahead." They are on 36-inch, diamond-shaped, reflectorized metal and painted in black on a yellow background.

The most effective device, introduced in 1936 and improved since, is the automatic short-arm gate working in conjunction with a flashing electric signal. When a train approaches, red lights flash. After three to five seconds, the gate, illuminated by a red light, descends, blocking the right half of the highway, but leaving the left clear so that a car can't be trapped. The gate rises only after the tracks are clear in both directions.

In the entire country, about 9000 grade crossings are equipped with these automatic gates and flashing lights, and some 33,000 with flashing lights alone. They are not cheap—the gate and lights cost over $20,000 to install—but even in wealthy New York State, less than half of the grade crossings have automatic gates or warning lights. They are being installed at the rate of only 30 a year, which means it will take 80 years to complete the job!

Some time back, Webster City, Iowa, residents were outraged to learn that the town could spend $2 million for an emergency power plant but not $5000 for an automatic gate (the necessary wiring circuits are already there with the present signals). In Houston, people stood on a railroad track in protest of the lack of even a warning signal at a crossing where six had recently died.

A few communities are trying to reduce grade-crossing accidents with $100 motorist fines and court appearances for violations at crossings. San Joaquin County, Calif., launched such an enforcement campaign several years ago after eight teenagers were killed at a crossing when their minibus became stalled. This county has six railroads and nearly 1000 grade crossings—probably more than in any comparable area in the world.

A "near miss" educational campaign is being sparked by the National Safety Council. Train crews on 12 railroads now record reckless motorist behavior which could result in a collision. Railway officials promptly report these violations to a driver's company or school district, or contact the offending motorist himself.

The ideal solution, of course, is to eliminate grade crossings by building overpasses and underpasses. But this is almost an impossible task. There is one public grade crossing (and perhaps one private) for every mile of the 220,000 miles of rail track in the United States. "Universal grade separation would cost about $100 billion—four times the total investment of all our railroads combined," estimated John A. Volpe when he served as Secretary of Transportation.

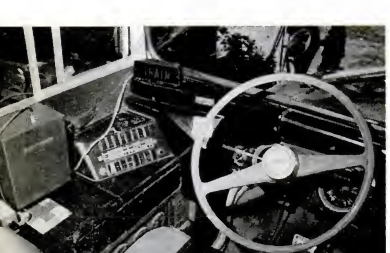
The problem is complicated by the open-





Another tragedy occurred early this year at Littlefield, Tex., when a Sante Fe freight plowed into a bus carrying 29 children. Seven were killed and 16 hospitalized as a result of the crash.

Research is a vital need



Receiver in Solitron system is in box at left. When it picks up signal, it triggers warning device.



Display box produces series of "beeps" as well as visual warning to driver. System can't be turned off.

ing of several hundred new grade crossings each year. New roads, especially in expanding suburban areas, are still being built across railroad tracks. Result: Though the United States has been eliminating grade crossings since the turn of the century, today there are more than existed in 1900.

Grade-crossing improvement costs big money. Federal funds are available, but they are restricted to use on federal-aid highway systems, which limits this source to some 47,000 crossings. And even these must compete with all other highway improvements for available federal highway funds. In 1970, for example, only $120 million out of more than $5 billion in federal highway trust funds went into grade-crossing projects.

Some 16 states have launched their own grade-crossing protection and maintenance funds. Unfortunately, other states spend their motor vehicle and gasoline tax monies on everything from oyster propagation to mosquito control—but not on grade-crossing safety.

A basic attack on the whole problem has been started by the Federal Railroad Administration (FRA) and Federal Highway Administration (FHWA). It involves the making of an inventory and detailed description of every grade crossing in the nation. The study is now underway in five states; eventually it will include all 50. The information obtained will be keyed to accident data and used to develop a system of grade-crossing priorities.

Another federal study is designed to assess driver understanding and reactions at various types of crossings.

New technical improvements are also in the works. A protection system under development for the Department of Transportation uses a continous microwave signal (rather than track circuits) from a point up-track from the grade crossing. When a train passes a sensor, the microwave signal is turned off and the crossing devices—flashing lights or gates—are activated.

This system can operate in all kinds of weather. While it would give essentially the same message to the motorist, it would probably cost less to install and maintain than the present electric warning systems.

Another study, involving train visibility, is being conducted for the FRA by the National Bureau of Standards. This includes the development of on-train visual aids such as attention-arresting lighting and reflective devices and a study of the effectiveness of various paints and reflective materials.

An improved version of the common crossbuck is suggested by Dr. David M. Lipscomb, a scientist at the University of Tennessee. He would equip it with six equally spaced white lights that would begin to flash randomly at the approach of a

(Please turn to page 190)

Fitting out for bass

It's top tackle that takes the tournament lunkers; here's what the experts use

by Gene Nichols



Fishermen who want to try different gear for getting bigger catches can match tourney winner Martin's bait-casting rig, bass-boat choice.

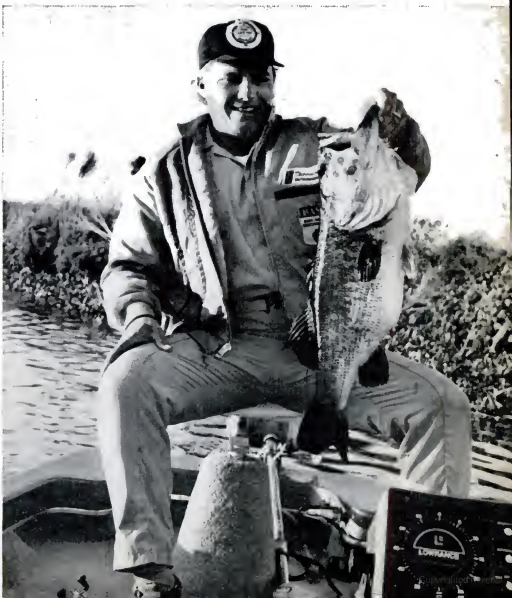
Roland Martin has already won over $30,000 in B.A.S.S. events with catches like 12-lb. largemouth this spring from Rodman Reservoir, Fla.

Largemouth bass have become the most sought-after game fish in the country, and the bass boom has inspired a lot of new and specialized tackle and gear.

Professional fisherman Roland Martin has been called the world's best bass angler, and we asked him for an exclusive summary of his recommendations for PM readers. A former Army officer and schoolteacher with a B.S. degree in biological sciences, Martin was named Bass Angler of the Year by the Bass Angler Sportsman Society (B.A.S.S.) in 1971 and 1972. He has now won over $30,000 on the tournament circuit to top Bill Dance and is presently leading in B.A.S.S. competition points for this year. Here are the equipment suggestions from the 32-year-old ace from Tulsa:

Rods: Bait-casting tackle is the choice of many tournament fishermen, with a very sensitive tip combined with plenty of backbone for turning big ones before they can hang you on brush piles and stumps. Spinning, spin casting and fly casting can also be effective for bass. Martin's $50 3M-Phillipson Bass Slayer is the 5½ or 6-footer.

Reels: Among fine bait-casting reels now





available are the Penn Levelmatic, Garcia Ambassadeur, Shakespeare, Daiwa, Sears and Pflueger. Says Martin, "Drag, free spool mechanisms and braking systems are keys to quality." Narrow spools, for better line control, are easier for the beginner.

Lines: Choosing a quality brand is essential to prevent stories about "the one that got away." A bargain-basement line can break just when the pressure's on. Among today's popular reliable brands are DuPont's Stren, Cortland Line Micron, Bonnyl, Berkley, Shakespeare and Perlene. Martin rates proper softness for casting distance and accuracy, knotting strength and resistance to wear as all very important.

Bass boats: Today's fast fishing machines have come a long way since the old-time skiffs. Speed, stability, maneuverability, shallow draft and ability to handle rough

Knife choice for bass busters can range from the Garcia survival sheath knife shown at upper left to a number of folding models.

Bait for bass includes the varied collection of "New Reliables" from Garcia shown below, with worms, plugs, jigs and rattlers.



offshore water are requirements. Martin's own Ranger also features bait wells with aerators, fish box, steering console, cushioned seats and other refinements.

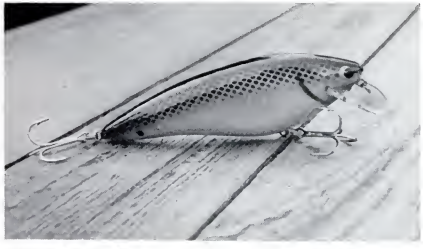
Outboard motor: Powerful but matched to hull, easily serviced, low profile, rugged prop, power trim are Martin preferences.

Electric outboard: A silent, light little mill with comfortable controls, low battery drain is the choice of bass busters. Martin uses a Sivertrol electric up front, a Johnson 135 on the transom.

Fish locators: Dedicated anglers swear by the new electronic structure and lunker spotters. A top model should suppress outboard motor and subsurface bubble interference, and be water and rough-usage resistant. Martin's is the new 660 Locator/Sounder, from Lowrance Electronics, that can be read down to 660 feet.

Lures: There are thousands on the market and the ardent bassman stocks a variety. Plastic worms, bugs and frogs are effective. Spinner baits are good at depth or on the surface where a buzzing Aggravator can anger a bass into striking. Jigs work well. Surface plugs were the first bait-casting artificials, and currently balsa surface lures like the Big O and Bagley Bait's Big-B are hot. Other favorites include Hula Poppers, Jitterbugs and Tom Cats, plus swimming lures like the Rappalla, Rebels and Mirro-Lures.

Accessories: Roland Martin recommends foul-weather gear, cap with bill, Polaroid sun glasses, underwater thermometer, hooks and sinkers, long-handled landing net, filet knife, CB radio, screwdriver, tackle box, jump suit, deck shoes, plus all your own preferences. ★★★



Tournament anglers nowadays favor a pregnant balsawood minnow. Bagley's is called the Big B.



Switch Blade from Bagley's won 1972 National Bass Open. The lure can be ripped along the surface for a buzz effect or fished deep with a slow retrieve.

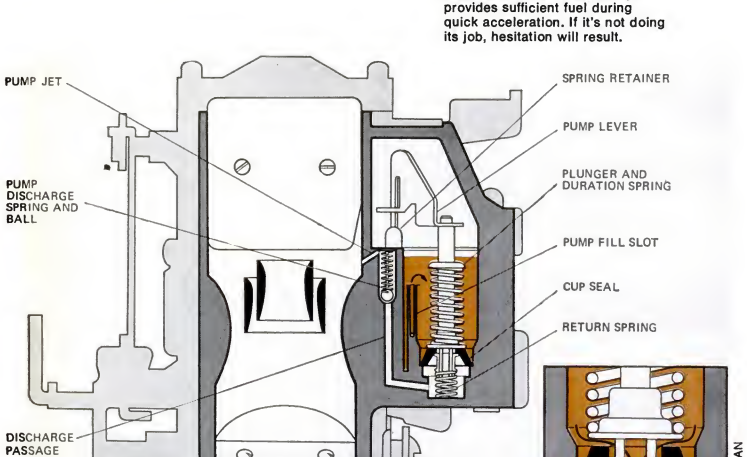


Multipurpose pliers should be able to crimp and cut; may also disgorge hooks, open cans and bottles, scale your catch.

Fast fixes for a hesitation problem

by Mort Schultz

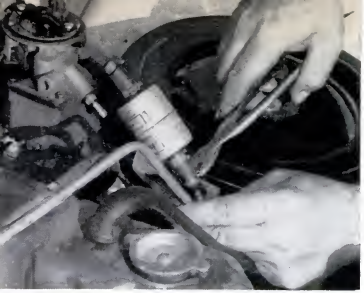
Carburetor accelerating pump provides sufficient fuel during quick acceleration. If it's not doing its job, hesitation will result.



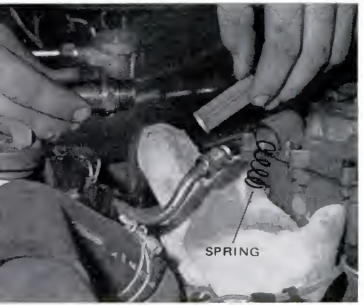
Some call it flat-spot acceleration. Others call it stumble. Whatever you call it, it's lag as you give an engine gas in a situation calling for quick response. The engine doesn't pick up promptly. It falters. Here's a troubleshooting sequence for tracking down a hesitation problem.

Accelerating pump. When you press down on the gas pedal to pick up speed rapidly, the amount of air flowing through the carburetor is increased. Gasoline, being heavier than air, lags behind. Thus, the engine would momentarily be starved for gasoline were it not for the accelerating pump which shoots gas into the carburetor.

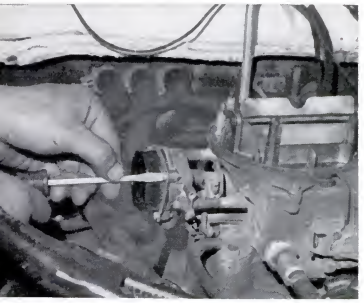
To check your accelerating pump or accelerating pump circuit, warm up the engine so the choke plate is open, turn the engine off and remove the carburetor air cleaner. Have someone step up and down on the gas



In-line fuel filter that's partially clogged will obstruct the smooth flow of fuel to the carburetor. To replace, remove clamps from both ends of the fuel lines at the filter and insert a new filter.



Internal-type fuel filter is found at inlet to the carburetor. When clogged, it, too, will restrict fuel flow and cause hesitation. When replacing, take care not to lose retaining spring; it can be reused.



Automatic choke, if not adjusted properly, will cause hesitation while engine is cold. Choke controls on carburetor are adjusted by loosening retaining screws and rotating cover one notch at a time.

pedal quickly two or three times, or manipulate the accelerator yourself by actuating the throttle lever to simulate a rapid acceleration situation. A stream of gasoline should squirt into the carburetor each time the gas pedal is pressed.

As the throttle linkage moves (this is the linkage from the gas pedal to the throttle lever), examine it closely. Movement should be smooth—no hangups that could cause lagging acceleration. A dirty or bent linkage should be fixed.

If the squirt of gasoline shooting into the carburetor is weak (or there is no squirt), the accelerating pump is probably bad or the pump circuit is clogged. In either event, the carburetor should be disassembled for service. But first check another possibility —the fuel filter.

Fuel filter. How long has it been since you replaced the fuel filter? A partially clogged filter may cause engine lag on acceleration. Every car has a fuel filter— either in the fuel line between the fuel pump and carburetor or inside the fuel inlet at the carburetor. Replace the filter; it may be obstructing full fuel flow.

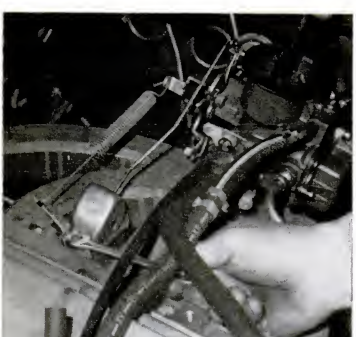
Automatic choke. Does hesitation occur only when the engine is cold? There's a good chance that (1) the automatic choke is misadjusted; (2) the vacuum break is out of whack; (3) the exhaust emission control system isn't working just right.

The automatic choke provides a richer fuel mixture for cold-engine starting and operation. If the choke isn't adjusted correctly or if it is sticking, engine performance will suffer until the engine warms up.

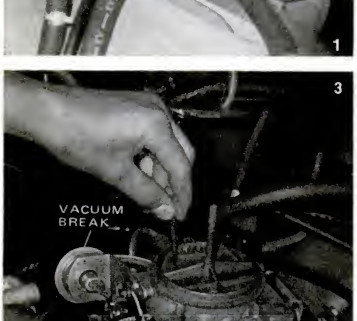
To check choke operation, remove the carburetor air cleaner and start the cold engine in the proper manner. Depress the accelerator pedal to the floor one time before turning the ignition switch. The choke plate should close over the throat of the carburetor. As the engine starts and idles, the plate should open partially, then wider and wider until it is fully open as normal operating temperature is reached.

If the choke sticks, clean dirt off the linkage and from around plate pivots. There are several different brands of good-quality choke cleaners available.

Rule out misadjustment of the choke as a cause of hesitation by readjusting the choke







1 **Automatic choke,** if not located on the carburetor, will be found at the manifold. The well-type choke has a cover that is removed before adjusting.

2 **Well-type automatic choke** is adjusted after unbolting cover. Loosen thermostatic spring retaining nut and move control to rich side one notch.

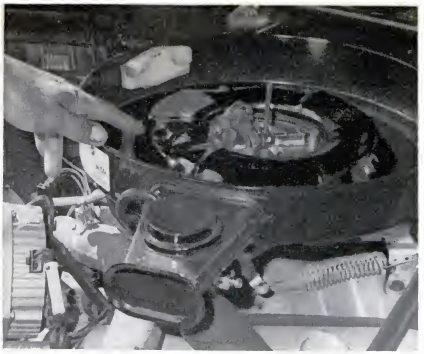
3 **Vacuum break,** which prevents overchoking, is set by placing proper size gauge between choke plate and carb wall and bending choke rod (see text).

to provide a richer fuel mixture. This is trial-and-error, but worth the trial. There are two common types of automatic choke controls. One has a thermostatic spring in a round housing on the side of the carburetor.

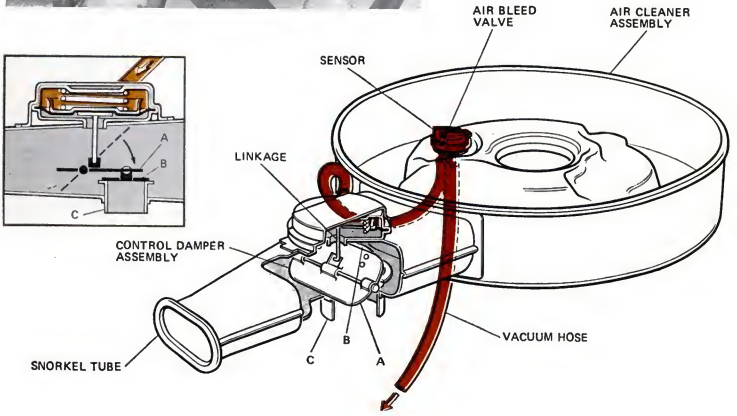
The other choke control has a thermostatic spring inside the manifold, with a fairly long rod extending from the control to the choke plate. This is called a well-type automatic choke.

Resetting the choke control on the carburetor is done by having the choke plate wide open and loosening several retaining screws. Rotate the housing cover one notch to the rich side as marked on the cover. Tighten the screws. Now, test engine pick-up with the engine cold. If the hesitation problem persists, move the choke control one more notch to the rich side. If results are still the same, give up. Your lag problem isn't caused by the choke. Move the control back to its original setting.

If your car has a well-type choke, check that the choke plate is open and unbolt the choke housing (it's a small domed metal cover) from the manifold. Lift out the choke control. Loosen the retaining nut, move the control one notch to the rich side, and proceed in the same way described for



Carburetor-air-cleaner housing of late-model cars incorporates thermostatically controlled valve to supply preheated air to carb while engine is cold. Air is picked up at hot exhaust manifold and enters flange C on the snorkel tube via flexible hose. Butterfly A closes off snorkel tube and preheated air goes directly to carb. When engine is running at operating temperature, butterfly A opens, cover B closes off hot air from the manifold and outside air goes directly to the carb through the snorkel tube.



servicing the carburetor-mounted control.

Vacuum break. The purpose of a vacuum break is to prevent overchoking. In general, when a cold engine starts, manifold vacuum is transmitted through a channel to a vacuum-break diaphragm that opens the choke plate partially so the engine will run without loading up. If this part isn't adjusted correctly, hesitation is possible.

Don't confuse the vacuum break with the choke unloader. The purpose of the unloader is to allow leaning out of the fuel mixture should the engine flood as it's started. By depressing the accelerator pedal to the floor and keeping it there, you set the unloader mechanism into motion to force the choke plate open part way, allowing extra air to lean out the fuel mixture.

Consult your service manual to determine how to adjust your vacuum break. Generally, adjustment is done by seating the diaphragm and placing a specified size gauge between the lower edge of the choke plate and wall of the carburetor. If the opening is too small or too wide, the vacuum-break rod, choke rod, or vacuum-break link is bent until the gauge is made to fit properly.

Emission control. If your car is a 1968 model or newer, it probably has a thermo-

(Please turn to page 188)

Make your own rotary cutters for those offbeat jobs

by Walter E. Burton

PHOTOS BY THE AUTHOR

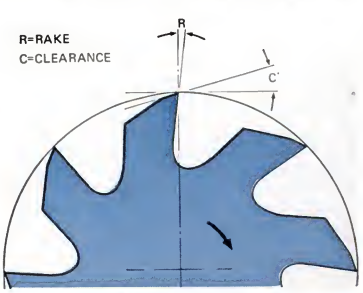


Five special cutters from blanks ready to be hardened. From left: "Saw" for cutting ⅛-in.-deep grooves and producting matchstick strips for modelmaking; two-flute router for cutting 5-mm grooves; two-edge molding cutter; cutter with pilot tip (similar to Woodruff keyseat cutter) for 3/16-in. groove ⅛ in. deep; double-head cutter for forming matching tongue.

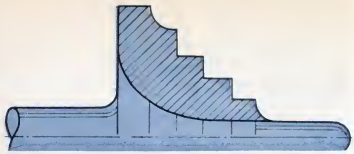
No matter how many small router bits or similar rotary cutters the home shop may boast, there are occasions when an offbeat type is needed but not available from normal sources. Often the shop owner can make the needed cutter. The photo shows a quintet of small cutters that were produced with typical lathe equipment.

Determining the precise size and shape of a cutter, as well as the form of the teeth, must be worked out. Often store-bought cutters can be used as guides, especially with respect to tooth shape. For cutting wood, a tooth preferably should have considerable rake and be formed by surface meeting at a rather sharp angle; for cutting brass there can be little or no rake.

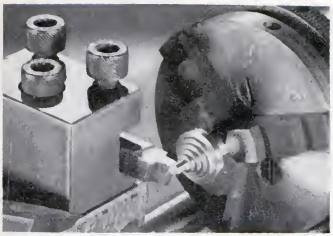
Making the blank. All cutters shown above have ¼-in. shanks. The two-flute, router-type bit was made from ¼-in. drill rod, the others from ½-in. drill rod turned

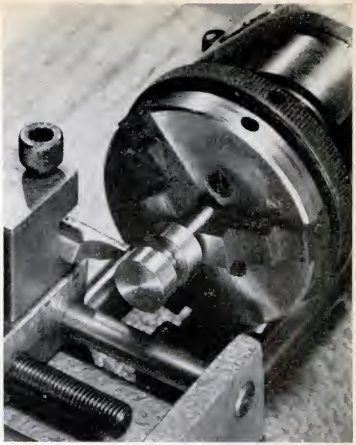


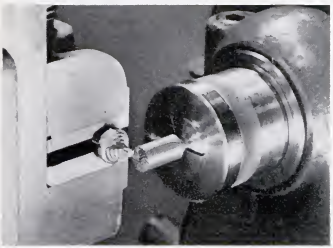
MILLING CUTTER



MOLDING CUTTER



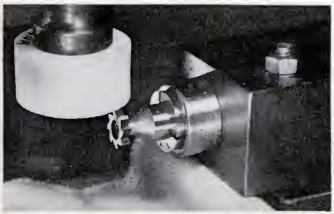




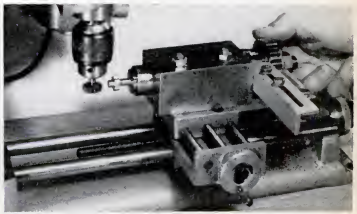
Round-nose cutter (top photo) forms cove grooves in special molding cutter. Square grooves were made with cutoff bit. Photo above shows end-cutting rotary file used to mill curved cutting notches.



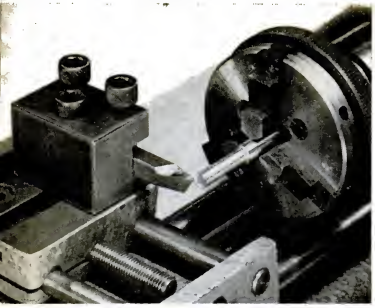
Two-headed, tongue-forming cutter (top photo) was blanked out with cutoff bit, then sides of heads were dished to reduce rubbing. Photo above shows how teeth of two-headed cutter were formed with file.

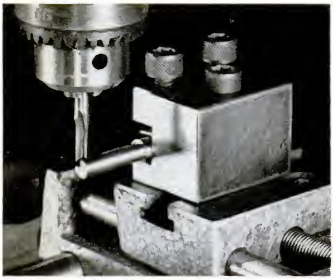


Unimat lathe, set up as a vertical grinder, touches up clearance on the teeth of factory-made cutter.

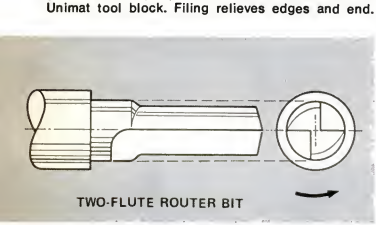


Woodruff keyseat cutter is used to rough-cut notches in 8-tooth cutter with aid of indexing attachment.





Two-flute router bit is being machined from ¼-in. drill rod (top) with end turned to 5-mm. diameter. In lower photo, longitudinal flutes (right-angle grooves 180° apart) are formed with blank held in Unimat tool block. Filing relieves edges and end.



down. To form the cutter contours, I simply ground the lathe bits to the appropriate shape.

Forming cutter edges. After the cutter blanks have been turned to the desired contours, it is necessary to "notch" them to produce cutting edges. There are various ways to do this. For precise spacing of cutting edges around the circumference, some sort of indexing arrangement is handy. An indexing head, such as that supplied as a Unimat accessory, can be used. It normally includes a collet or chuck for gripping the cutter shank. Notched or perforated plates enable the cutter to be rotated a certain number of degrees (fraction of a circle) at a step.

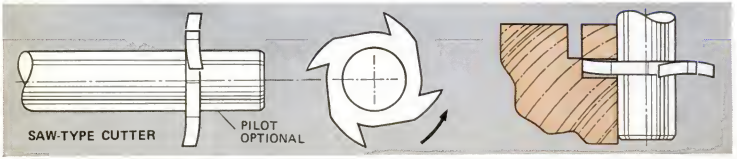
The shop-made indexing attachment shown at the bottom of page 151 uses standard lathe collets (from a 9-in. lathe) to grip the cutter shanks. It was described in *Indexing Attachment for Small Lathes* (page 223, Oct. '54 *PM*). It fits the Unimat perfectly, being fastened to the carriage T-slot with two ¼-in.-20 carriage bolts extending through vertical holes in the body block.

It is possible, of course, to form cutting edges without using an indexing attachment. Most cutters will work even if the cutting edges are not precisely spaced.

Cutting edges can be formed by milling. Here the router bit is clamped in the Unimat toolholding block and the two longitudinal flutes cut with a bit of similar shape. The conical molding cutter was clamped in a milling vise on a 9-in. South Bend lathe, and an end-cutting rotary file, operating much like an end mill, was used to rough out the two cutting edges.

The two-headed cutter, which resembles two Woodruff keyseat cutters on the same shank, was rough-machined on a lathe with a parting-tool bit. The head was divided into eight reasonably equal parts and marked with a file. Hacksaw cuts were made to a depth of about 1/16 in., then files were

(Please turn to page 190)



HINTS

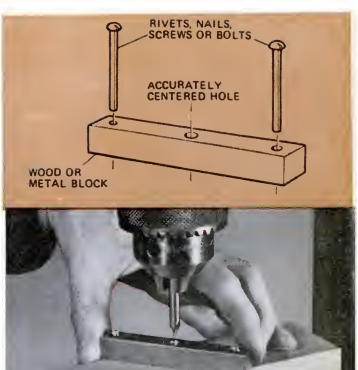
FROM READERS



Tagging chuck jaws

When machining several identical parts in an independent-jaw lathe chuck, you'll save adjustment time by loosening the same jaws each time a piece is removed. To do this, mark the jaws to be loosened in any convenient manner—with dots of adhesive tape, for example.

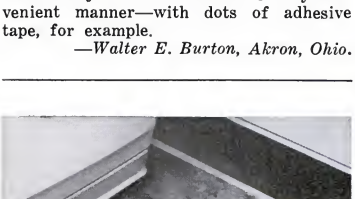
—Walter E. Burton, Akron, Ohio.



Centering device

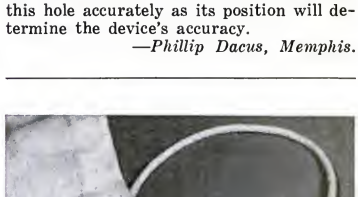
Made from any handy materials, this tool makes it easy to scribe centerlines and punch holes in pipe, boards or metal right on the button. The middle hole can be sized for a desired drill. Just be sure to center this hole accurately as its position will determine the device's accuracy.

—Phillip Dacus, Memphis.



Inexpensive cleaning aid

A plastic golf-club tube can be used as an extension nozzle for a vacuum cleaner for getting under refrigerators and into other tight places. The flexible tube can be forced into openings too narrow for a rigid nozzle of the same size, and won't scratch furniture or appliances. Tube shown cost 10 cents.*—Burt Web, Skokie, Ill.*



Washer secures small knot

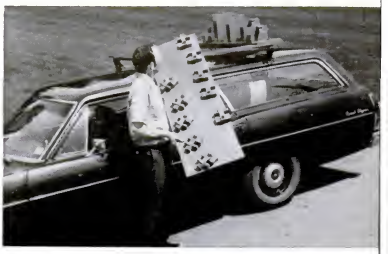
When a camper had to secure a tent flap by means of a grommet and rope, he found it difficult to tie a knot large enough to keep from pulling through the hole. With a flat washer from his car's toolbox slipped onto the rope behind the knot, rope and tent flap were held fast.

—Victor Lamoy, Saranac Lake, N.Y.



Bicycles for two adults and three children are mounted without disassembly on carrier. Wire passing through eyebolts attached to bike frames gives extra security. Unit is fastened to luggage rack with wingnuts, can be installed by one person, comes apart for convenient storage.

Cartop carrier transports bikes for the whole family

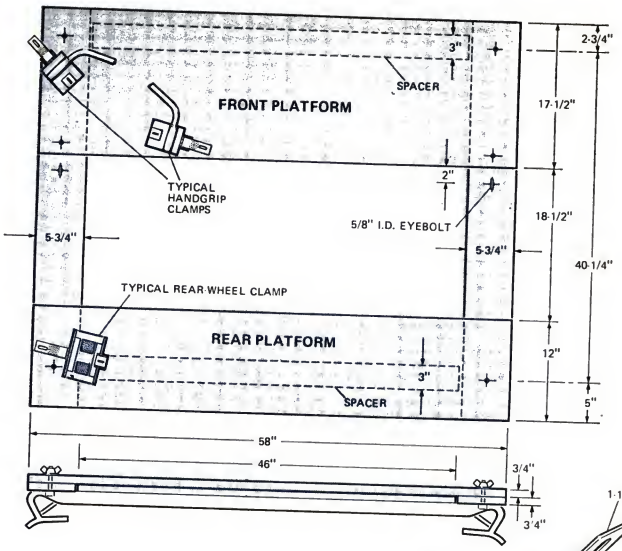


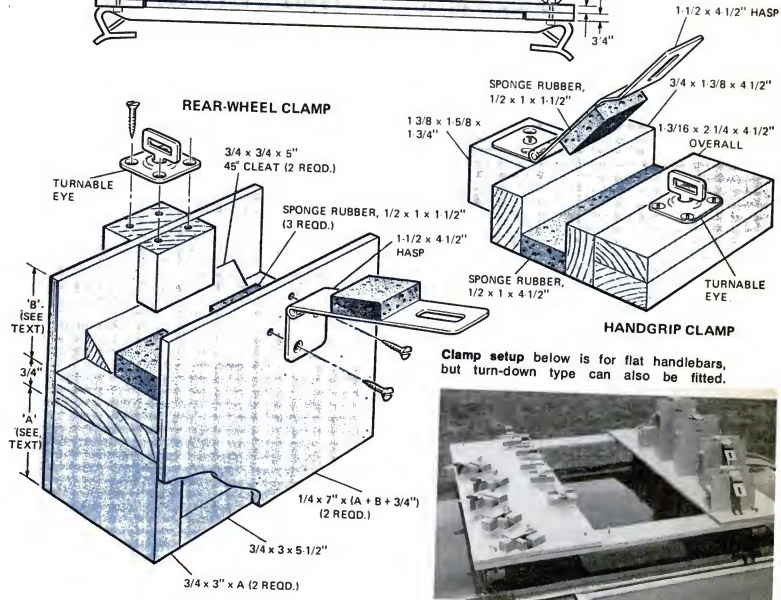
by Homer G. Wolfe

Transporting the family's bicycles to a distant starting point can be a chore. It usually means either partially dismantling the bikes or fussing with a tangle of tie-down straps. With a carrier like this, you and the family will have more time for bike riding since loading and unloading can be done in no time at all.

The clamps, consisting of garage-door hasps and turnable spring-loaded eyes, hold each bike firmly by its handlebars and rear wheel. I made the plywood carrier in one weekend for about $29; it is mounted on an inexpensive removable luggage rack.

Three clamps are used to hold each bike. To locate them, place the bikes upside down on the carrier in the desired positions. Handgrip clamps are located and screwed down first. Then the height and location of each rear-wheel clamp is determined by blocking up the back fender until the bike seat is about even with the carrier platform. Distance from platform to fender minus ¾ in. gives dimension A in drawing on opposite page. Dimension B is calculated by measuring distance from outside of bicycle fender to inside of wheel rim, then adding ⅜ in. allowance for compressed sponge rubber. Since all clamps are custom fitted to individual bikes, they should be fastened to the carrier with screws only—you may later replace a bike. Spacers shown in the drawing are not structural; they're designed to prevent wind noise. ★★★





Clamp setup below is for flat handlebars, but turn-down type can also be fitted.



Scoring picture and window glass squarely is easily done by aligning edge with grid lines in cutting board and drawing glass cutter along hinged nonslip straightedge. Latter serves as pressure bar, too.

Multipurpose cutting board

handles glass, cardboard, photo mats and roll paper

by C. E. Banister

A good cutting board is a valuable tool for both shop and darkroom work. Besides giving you accurate results every time, one will keep other surfaces from being marred by routine cutting jobs.

This board can be scaled to any size that meets your needs. Rather than incorporating a knife, it allows you to use the cutting tool most appropriate for whatever job you're doing by running it along a solid metal straightedge. The adjustable stop facilitates repeated cuts. If you are left-handed, you'll find the board easy to work with, too. The cost of materials is under $10.

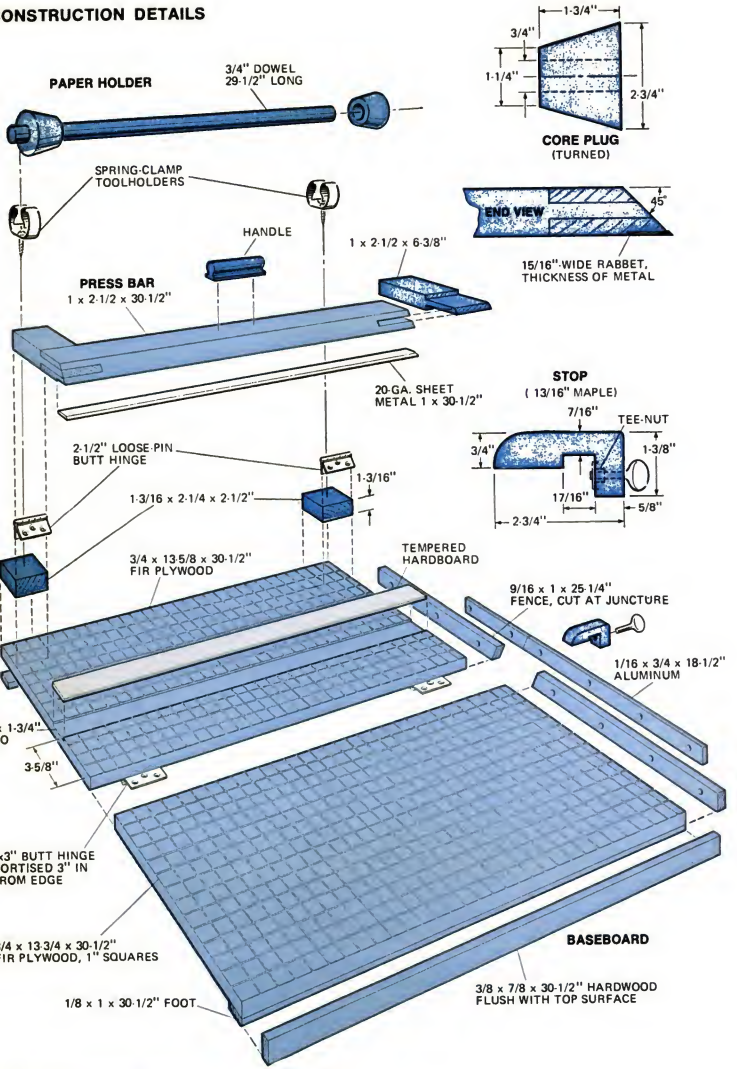
Dimensions given in the drawing on page 158 are for a board about as large as you can work on comfortably. If you scale it down, the press bar should still be at least 13/16 in. high and 2 in. wide, and of a good grade of hardwood. For the baseboard, I used fir plywood, 3/4 x 27 1/2 x 30 1/2 in., cut as shown. Note that the press bar and its extensions are 1 in. thick overall, while the anchor blocks are 13/16 in. thick. This allows material up to 1/4 in. thick to be cut against the length of the fence. Thicker materials can be cut between the anchor blocks.

The 20-ga. sheet metal—I used galvanized—is 1 in. wide, rabbeted into the press bar so it is flush on the underside, and extends 1/16 in. beyond it. The metal is attached with contact cement; clamping is advisable

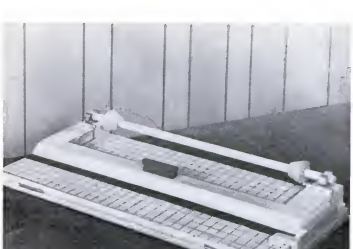


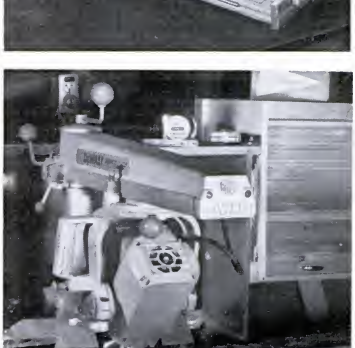
Versatility of cutting board is demonstrated by its handling of a wide variety of materials. At top, picture mats with beveled edges are readily and accurately made. Bevel of press bar makes cutting angle precise. Middle photo shows board with stop removed to permit cuttng of extra-large sheet. Roll-paper holder, shown in use in bottom photo, allows cutting of roll materials up to 24 in. wide, including photographic paper (under recommended safelight).

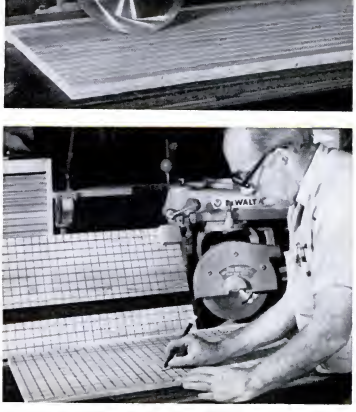
CONSTRUCTION DETAILS



Cutting surface is replaceable







for this step, and be sure there's always adequate ventilation when you're working with contact cement. The 45° cut on the press bar is made after the straightedge has been cemented in place.

The anchor blocks, attached to the baseboard with screws and glue, must be positioned accurately, since they will determine the ultimate squareness of the board. Small errors can be compensated for by shimming the hinges connecting the blocks to the press bar.

The routed or plowed $\frac{1}{8}$ x $1\frac{3}{4}$-in. dado in the baseboard is for the replaceable tempered hardboard cutting surface, which should be cut for a snug fit. There are actually four different cutting surfaces, as the hardboard can be turned end for end, then turned over and finally turned end for end again before replacement.

The fence is secured with $1\frac{1}{2}$-in. No. 10 screws, and the $\frac{1}{16}$-in. aluminum, on which the stop rides, is attached to it with No. 4 screws. A commercially available metal tape with a pressure-sensitive adhesive back was used for the scale; a yardstick ripped to the proper width would be a suitable alternative.

Core plugs for the paper holder are turned on the lathe using the screw center and bored for $\frac{3}{4}$-in. dowel before being cut off from waste stock.

It is advisable to clamp the assembled anchor blocks and press bar to the baseboard before laying out the 1-in. squares. Measurement should start from the metal straightedge on the press bar for the lines that will be parallel to it, and from the upper edge of the baseboard or fence for the others.

Stain and finish the completed cutting board as desired. I used a clear resin sealer and urethane varnish. ★★★

Cutting board folds for storage (top left), but can be built more simply when space is no problem. With the folding feature omitted, the ¼-in feet, otherwise required by hinge thickness, are no longer needed. In middle photo, V-grooves are cut ½ in. deep with thin saw blade set at 45°; a single pass will complete each V-cut. A molding head with V-knives could also be used. At left, grooves are darkened with fine-point felt-tip marking pen before final finishing of the board. Paint or India ink could also be used.

Playback tennis 'court' improves your backhand

Plywood sheet with folding wings lets you switch from basketball to tennis for back-yard practice.

by L. H. Nichols

Basketball for the kids and tennis for you—or vice versa. This unit lets you practice both, combining a regulation-height basket and backboard with a removable tennis practice wall. You can switch from one to the other in minutes because the tennis wall is attached with screw hooks and eyes.

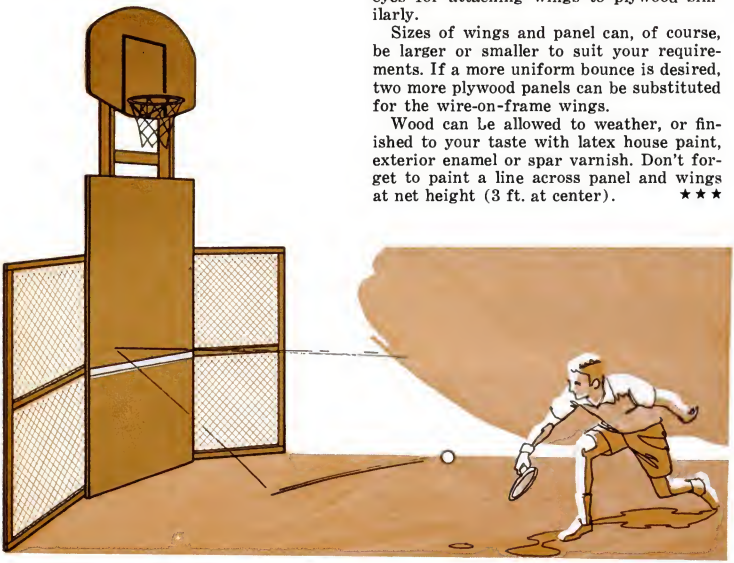
Uprights are 2x6s, spliced with ½-in.-dia. lagscrews, if necessary, to make the proper height. Diagonal cross members are also 2x6s and may be mortised into the uprights. A 2x4 crossbar and toggle bolts secure the unit to the overhang of house or garage. Basket and backboard, purchased as a unit, are attached to uprights with screws so that the basket rim is 10 ft. above the ground.

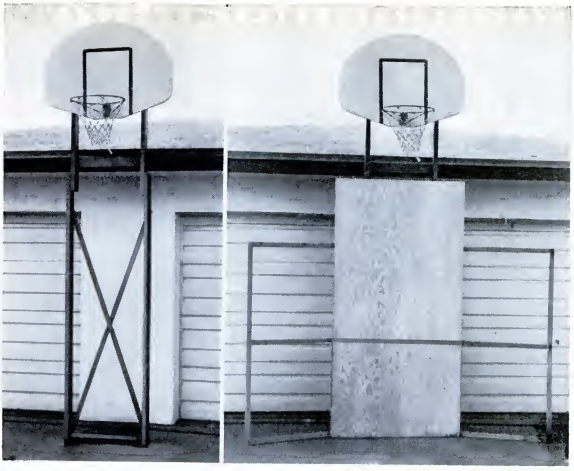
Wing frames of 1x2s are assembled with nails or corrugated fasteners; then galvanized netting is stretched across framework and stapled in place. Lattice strips may be used to conceal netting edges.

To install hooks and screw eyes, hold the plywood panel against the uprights to center it, and then mark locations of hooks and eyes for a tight fit. Locate hooks and eyes for attaching wings to plywood similarly.

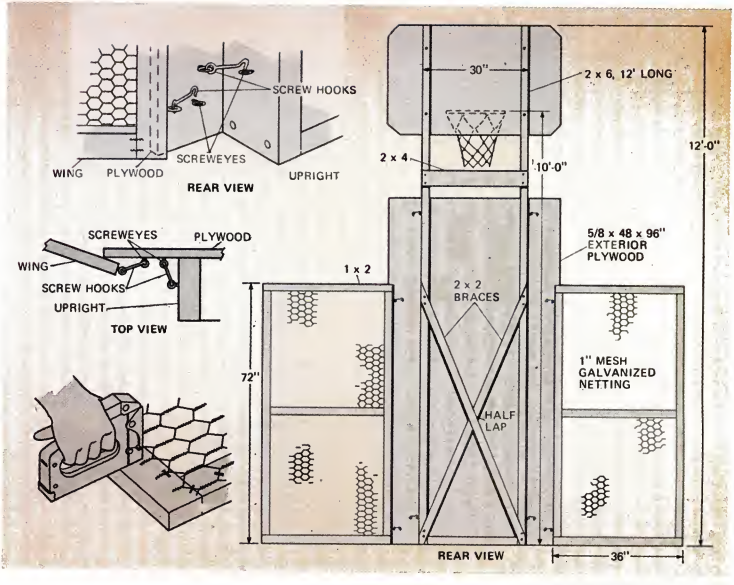
Sizes of wings and panel can, of course, be larger or smaller to suit your requirements. If a more uniform bounce is desired, two more plywood panels can be substituted for the wire-on-frame wings.

Wood can be allowed to weather, or finished to your taste with latex house paint, exterior enamel or spar varnish. Don't forget to paint a line across panel and wings at net height (3 ft. at center). ★★★





Conversion from one sport to another is nearly instantaneous. Tennis setup (near left) gives a lot of area to hit ball. For basketball practice (far left) the backboard uprights are unobstructed.



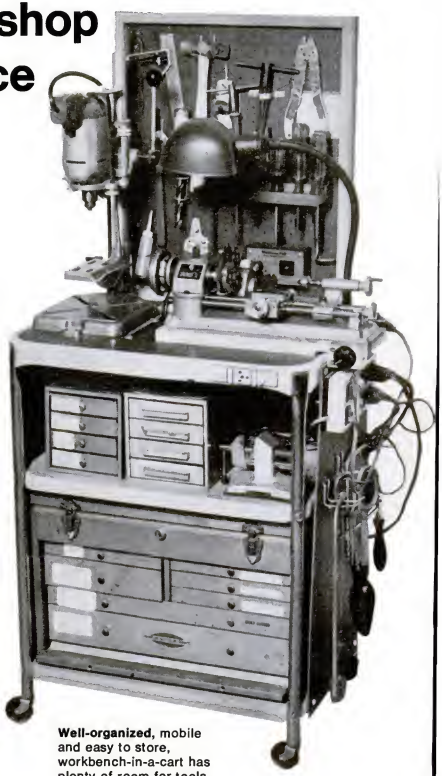
Roll-away workbench packs a lot of shop in a small space

by Charles Green

For the hobbyist who has no permanent place for his activities, this rolling mini workbench is ideal. Built around a caster-mounted metal serving cart—the type sold at department stores—it is especially handy if your space is limited because it can be stored in a closet. It keeps everything together too; you simply stow your toolbox collection on the shelves and have three toolboards for tools too big for the boxes.

Dimensions given are for the bench shown in the photos; these can be varied to suit the cart you buy.

Use clear pine to construct the toolboard frame; the square cleat in front of it, fastened to the cart top, gives added rigidity. If greater rigidity is required, fasten a piece of ¼-in. plywood to the underside of the top. Bolt two pieces of perforated hardboard to the sides of the cart for convenient tool-hanging space as well. Either end panel is also a logical spot for mounting a duplex convenience outlet. The gooseneck lamp allows you to aim the light where it's wanted; or you can mount a high-intensity lamp on the toolboard. Weight of the machinist's tool chest gives ample stability; if necessary, you can replace the cart's casters with heavy-duty ones. ★★★



Well-organized, mobile and easy to store, workbench-in-a-cart has plenty of room for tools and project parts. Bench consists of toolchest mounted in a $12 metal serving cart (available at most department stores). Rest of materials—hardboard, wood, hardware—add just a few dollars to the cost.

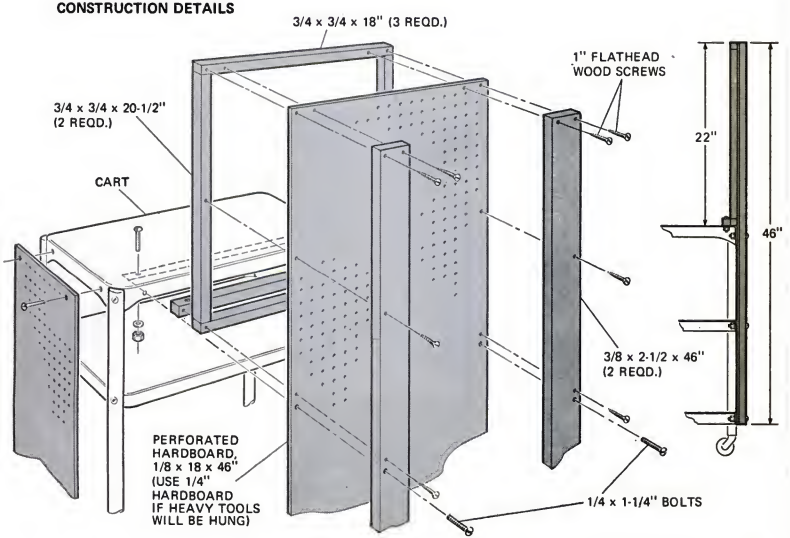


View from rear shows rolling bench's simple construction—hardboard panel and uprights bolted to cart frame.



Benchtop height should be as close to 30 in. as possible for most comfortable sit-down working. Power outlets and controls are within easy reach. Standard hangers hold tools on hardboard panels.

CONSTRUCTION DETAILS



HINTS

FROM READERS



Slip-proof paper cutter

To keep photos and other materials from slipping on the board of a paper cutter, try using masking tape to provide a nonslip surface. One strip of the tape is placed next to the cutting edge, another along the top adjacent to the guide and two more along the board's diagonals.

—Ken Patterson, Regina, Sask.



Chisel template for mortising

An easy and accurate way to guide a chisel when it comes to cutting several same-size mortises is to use a sheet-metal template. It can be made with the chisel from a scrap of soft aluminum and attached to the workpiece with tape or clamps. Once mortise is started, template is removed.

—Walter E. Burton, Akron, Ohio.



Drafting tool rounds corners

Faster than a compass, a draftsman's circle template is a handy tool in the shop for quickly marking corners on work to be rounded. Two types of templates are shown. A French curve, marked with tape, is great for "freehand" contours that must be duplicated or drawn in a reversed position.

—E.B. Walters, Chicago.



Rubber bands from gloves

Next time you get a hole in a rubber glove, don't toss out the glove. It has considerable salvage value when used to make rubber bands of various sizes—small ones from the fingers, large ones from the wrist. Bands can be made as wide as desired for many uses around the home and shop.

—William Swallow, Brooklyn.



Joe Weider, fitness expert and trainer of champions since 1936 says:

"Give me 5 minutes twice daily for only 7 days and you'll lose up to 3 inches from your waistline, up to 10 pounds of unwanted weight, and 'shape up' — or I will return every penny."

Let's face the facts why you're out of shape.

You eat the wrong combination of foods, you do not get enough exercise to thoroughly work your muscular, metabolic and respiratory systems daily. Because of this, fat accumulates around your waistline, heart and other body organs, slowing you down, aging your body and destroying your vitality, virility and youth. There is only one way to firm up and shape up: that is through proper exercise and proper nutrition. Effortless exercisers, reducing pills, sauna shorts, weighted belts, dangerous and painful diets and other gimmicks designed to appeal to your laziness will not work and have been exposed by the medical profession as frauds, ineffective and in some cases dangerous. They can only reduce your pocketbook. Face up to it...If you want to slim down, firm and shape up, you must work off the inches, and there is no safer, faster and more enjoyable way to do it than with our patented, truly miraculous "5" Minute Body Shaper Plan.

How does this ingenious "5" Minute Plan slim, firm and shape you up?

Its miraculous slimming action is based on doing one simple "5" Minute Continuous Rhythm coordinated exercise! **That's all you do!** That's all your body needs to help make up for the lack of activity it doesn't get most of the day. The action is designed to supply your waistline and hipline (where fat accumulates quickest, giving your body a flabby, weak and distorted look) with the activity it needs to slim you and keep you slim. It also burns off excess fat FAST by speeding up your metabolism and respiratory system, using up stored calories, carbohydrates and fats and releasing excess water, thereby shaping and firming up your total body!

Patent Pending. © Copyright Joe Weider, 1973

It's safer than strenuous gym workouts, beats the time consumption and dangers of gym workouts...or any other vigorous sport.

The unit weighs about 16 ounces and fits any wallet-size case. You can carry it with you and use it — anytime — wherever there's floor space for your body. Even while watching television.

What the experts say:

Medical Doctors, Chiropractors, Osteopaths, Athletic Coaches...agree it's the most successful Waistline-Weight Reducer and Shaping Up Plan ever invented!

"Doctors have always known, exercise done while lying on the back virtually eliminates strains while slimming and reshaping the body. Yours is the finest Body Shaper Program on the market."
RICHARD TYLER, Chiropractor

"Beats jogging and working out in gyms — and much safer. I lost 4½ inches off my waist in 14 days." JIM HANLEY, famous athletic coach

"Miraculous! Weighs less than a pound, is simple to use and beats working out in a gym with 30 different exercisers."
TOM MINOCHELLO, famous gym owner

"Based on sound physiological and medical knowledge, it burns fat and shapes the body without strain to the heart or other organs. I lost 32 lbs. of excess weight using it."
PIERRE GRAVEL, DC

'5' MINUTE BODY SHAPER

We'll slim your body... while you watch the girls!

What comes off in 14 days?

Individual results vary, but during an average 14-day period you can expect to lose up to 4 inches from your waistline and up to 10 pounds from your present weight. It strengthens your heart and lungs, increases stamina and endurance, improves your digestive function and general health. It also shapes you up — from head to toes. For a "5" Minute Exerciser — it sure does a lot.



Weighs just 16 ounces. Small enough to fit into pouch shown.

FREE TRIAL OFFER: Get it off fast...and see measurable results in three days or every penny back!

Proven results are already verified by the thousands. The guarantee is in writing. Now, can you think of a reason for not ordering your "5" Minute Total Body Shaper and start looking and feeling like a million...in just 3 days?

DISCOVER A NEW JOY IN YOUR BODY

GIVE IT SEX APPEAL!
COMPLETE KIT ONLY **$9.95**

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"5" Minute Body Shaper Plan
21100 Erwin Street,
Woodland Hills, Ca. 91364

Dear Joe: Rush me your '5' Minute Body Shaper and Slimmers Course in plain wrapper, with your money back guarantee offer!

I ENCLOSE $9.95 FOR THE ABOVE.
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How to fit a fairing and ride a racer!

by Wally Wyss

In Europe, the term "cafe racer" used to be a put-down. It referred to the motorcyclist who played at being an Isle of Man road racer, someone who owned a racy machine but merely parked it near his table at the local outdoor cafe. He still has the exhibitionism of the chopper builder, but the cafe racer really makes his bike more aerodynamic and often safer with his modifications.

The typical cafe racer's machine starts as a big road bike—350 cc or more. It's just a stock machine before the owner decides to go the racer route with bright colors and bullet fairing. The first step, usually, is to remove the stock handlebars and replace them with clip-ons. These are stubby little grips that demand a whole new style of riding. You have to hunch forward and lean more into turns. At low speeds, clip-ons





This Dunstall Norton is a Commando 750 given the slick treatment by special-equipment supplier and retired British road racer Paul Dunstall. At right: two extensively modified Suzuki X-6 Hustlers.



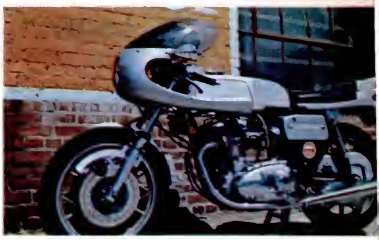
Kawasaki 750 still has its stock frame, but almost everything else right down to the pistons of the ported engine and suspension has been given hop-up treatment.



Honda 750 has an extra disc brake up front, a pair of Dunstall clip-ons, special tank and solo seat, Koni shocks and extractor exhausts. And, of course, a fairing—this one the full type.

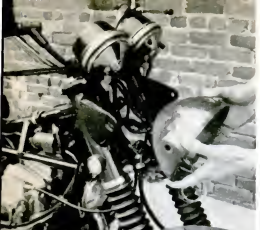


The disc brakes and magnesium wheels are only two of the fascinating details on this BSA (poised on its stand at right).



BSA cafe racer has a completely enclosed chain guard, stainless-steel bolts throughout and "engine-turned" brackets—a jewel of a machine.

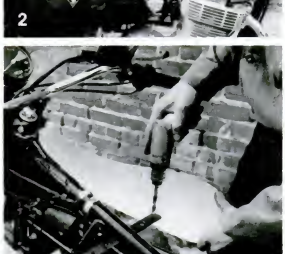


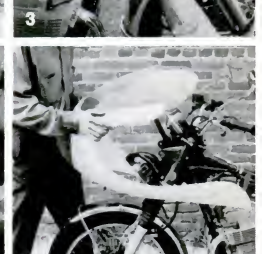












1. Removing the headlight housing is the first step in fitting this Honda 750 with specially designed half fairing with ready-made brackets. It will be reinstalled on the fairing.

2. Remove the original-equipment fuel tank for access to the frame of the motorcycle. You might have to flip the saddle up on its hinges in order to remove the tank.

3. Determine the best location for front support bracket on the steering head. Slide fairing on to check positioning before bolting it on. You could also choose to weld it.

4. Drill the fairing for the front-support mounting bolts. If you intend to mount speedometer, tach, oil and water-temp gauges on fairing dash, now is the time to do it.

5. Position the horizontal bracket on the horizontal frame tubes and check that gas tank clears it before bolting in place. Then drill the fairing for the mounting bolts.

6. Slide fairing on and attach. Reinstall gas tank, headlight and any other parts that were removed. Expect job to take about four hours—more if you must fabricate brackets.

are difficult to handle but not as unwieldy as the extended front forks of the typical chopper.

The next most frequent replacement is the seat. Most big bikes have a long padded seat suitable for two, but cafe racers, due to their semi-crouch riding position, need to move their fanny aft. Hence, no room for riders. Thus, the "solo" seat which usually sweeps up to offer support in back for the buttocks.

Fast growing in popularity are larger gas tanks—huge five and seven-gallon jobs that will take you a few hundred miles nonstop. Many of the new fiberglass tanks will bolt right onto a Honda and make it look as hairy as the ultimate factory cafe racer —the 1200-cc Mammoth Munch!

True to the original sarcastic definition of a cafe racer (their bikes are called "cafe racers," too), only a few of the machines seen in the United States so far have real engine modifications. The most frequent engine mod, if any, is the addition of racing-style extractor exhausts which give more power through a careful modulation of back pressure. Motorcycle cams are also becoming a popular item, much as they were with cars in the '50s.

Some more sophisticated cafe racers boast suspension work and expensive modifications like replacement of the front drum brakes with a hydraulic disc brake or even dual hydraulic disc brakes.

Wire wheels, while traditional with motorcycles, are not universally loved by racers, many of whom have had spokes

(Please turn to page 192)

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Benchtop saw table converts portable to 'radial'

by Wayne C. Leckey
HOME AND SHOP EDITOR

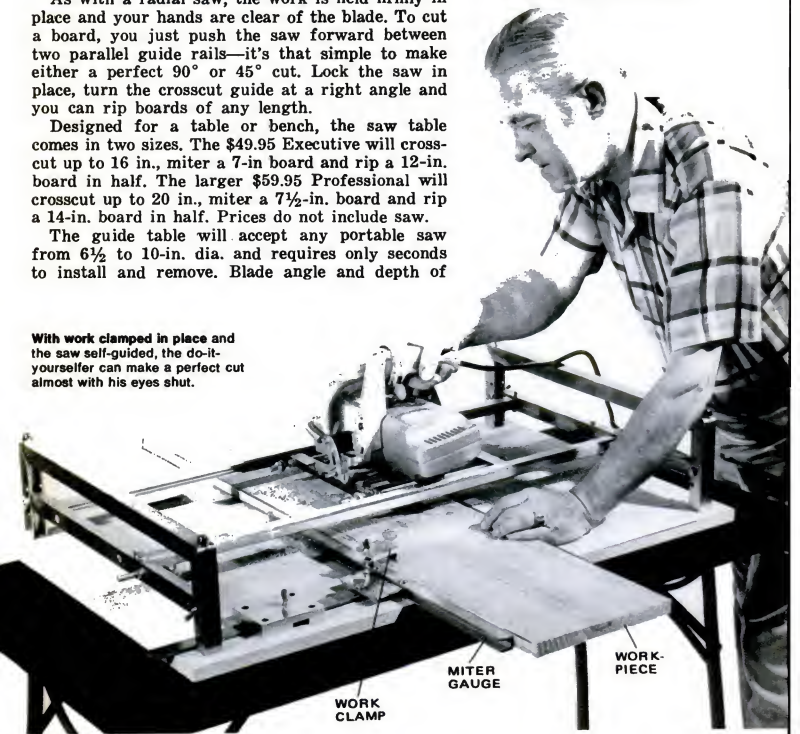
PHOTOS BY ROBERT D. BORST

Your portable power saw becomes a lot handier and safer with Safe-T-Track, a new benchtop saw table I've just tried. With it, a handyman can use his portable saw to crosscut, rip, miter, mortise, groove, bevel and dado with the precision of a radial-arm saw.

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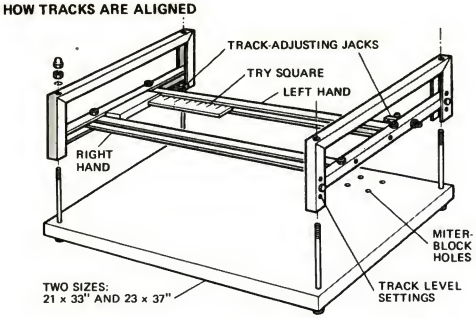
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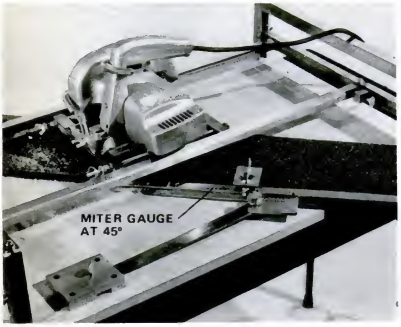
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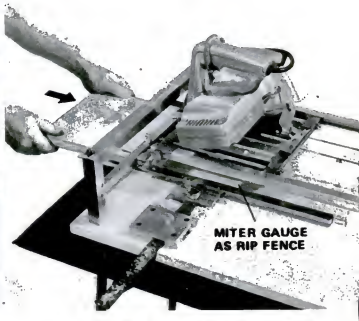
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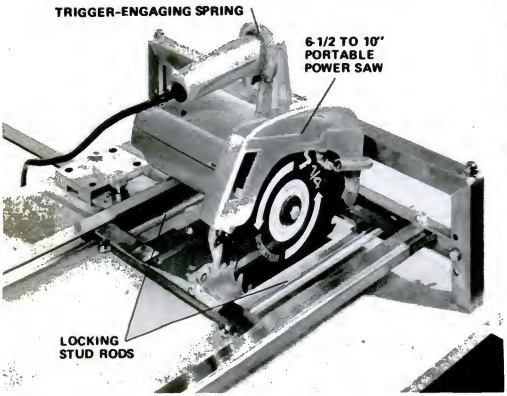


cut are set by adjustments on the saw. A saw carriage glides on stainless-steel bearings so you can use a hollow-ground (planer) blade without binding. With right blade, you can cut metal, plastic and stone.

If you have no portable saw, you can get the rig with heavy-duty 7½-in. Track Mate saw for $34.95 more. Toolco Industries, 3021 Nebraska Ave., Santa Monica, Calif. 90404. ★★★



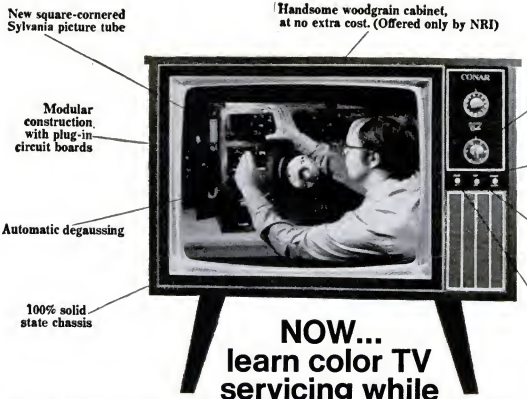




Miter gauge (above left) can be set to cut 22½°, 45° and 60° angles by backing out knurled knob from tapped hole. Hold-down thumbscrew keeps board from shifting; two-way clamp block permits the miter gauge to serve as a rip fence.

With saw locked in place at far end of table (above, right), you can rip a board by feeding it between end posts. Here the miter gauge is used as a rip fence to guide the board, and is adjustable for width of cut.

Carriage platform (left) is custom-fitted to suit your make and model saw. Saw can be removed in seconds when desired. Threaded stud rods allow carriage to be locked in place for ripping operations. Coil spring holds trigger in "on" position.



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THE SPLIT-LEVEL DESK

(Continued from page 83)

top and the apron, and install the well for the drawer. Remember to install the pullout tray before fastening the well to the desk—because of those fixed stops. Fasten the drawer to the slides and upright the desk so the ends can be laminated.

Construct the secretary return using the same technique. One advantage of this unit is that *the return does not have to be built right away*—it is not an integral part of the setup, as can be seen in the drawings and photos. You can build either one or both units to suit your personal needs and budget. The desk is handsome whether the return is used or not. And you can always add it later.

Costs could be kept down somewhat by using laminate on the top only and staining or painting the rest of the desk. But if you choose this course, you will have to use a cabinet-grade, higher-cost plywood. In any event, the top, at the least, should be laminated to provide a durable, trouble-free surface that won't be marred easily by ballpoint pens and pencils through paper.

The interior of the desk shown was finished by applying a sealer coat of shellac thinned 50 percent and following that with two coats of semigloss harvest gold latex enamel. The pencil tray is a quickie project in itself and is of great value for keeping small items from drifting to the rear of the shallow pencil drawer. ★★★

Manufacturers of materials used

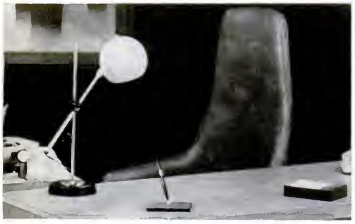
(Available locally, or write to the maker for nearest source.)

Drawer pulls—Amerock Corp., Dept. PM, Rockford, Ill. 61101. Knob No. 785 AE, pulls No. 185 AE.

High-back chair—Sears, Roebuck and Co., Model No. P3 KX 7778N, Tobacco. Order from your local store or through the catalog.

Plastic laminate—Formica Corp., Formica Building, Dept. PM, 120 East Fourth St., Cincinnati, Ohio 45202. No. 417 Honeytone teak, suede finish 64.

Drawer slides—Grant Hardware Co., Dept. PM, 141 High St., West Nyack, N. Y. 10994. No. 344-16-in. Add-A-Drawer slides for pencil drawer, and two pairs of No. 3320-16-in. slides for the deep drawers.



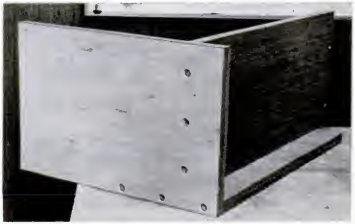
Executive-type chair with extra-high back enhances look of office setup—but any chair could be used.



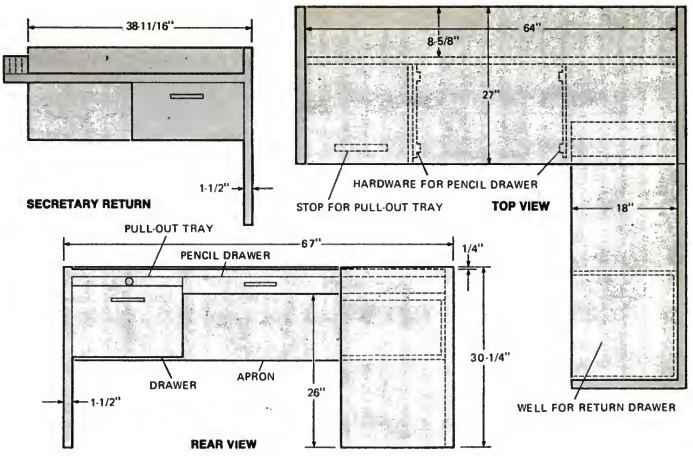
Doubled-up plywood panels achieve thickness of 1½ in. To assemble the panels, use screws and glue.



Assemble units dry for test fit, then disassemble for lamination. Underside of desk and return is shown.



Assemble sections with lagscrews in counterbored holes after partial lamination; then laminate the ends.





Access holes drilled in bottom of drawer compartments aid in mounting to underside of tops with screws.



Sturdy drawer slides easily support weight of fully extended drawer. Drawer is then fastened to slides.



Return with spacer block is shown at left end. Drawer front has not yet been installed on the drawer.



Underside view of desktop shows position of pencil drawer slides and stop blocks for tray and return.

THE WALL-HUGGER DESK

(Continued from page 75)



For permanent setup, desk can be supported on standard two-drawer filing cabinet in place of folding leg.

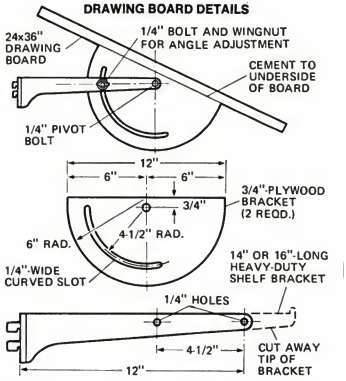
regular shelf supports. If you'd like more shelves in place of the bulletin board, these, too, can easily be added between the desk and cabinet, again using stock brackets. Other possibilities include magazine racks, pencil drawers, even a drawing board—all mounted by means of the same hook-in shelf brackets. Typical mounting arrangements for such accessories are shown below.

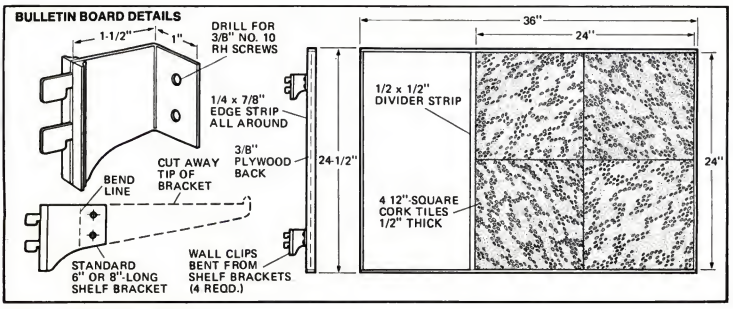
The main parts for both cabinet and desk can be cut from a single sheet of ¾-in. plywood. The rear portion of the desk is anchored to two 10-in. shelf brackets with metal angles. This holds it in place so it can't slip off as the folding portion is raised and lowered. Edge strips are fastened under the desk to give it the smart, modern appearance of a double-thick counter. The top and sides are then covered with a counter-

(Please turn to page 180)



Drawing board can be mounted on shelf brackets, as at right. Sketch below shows bulletin-board construction.





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THE WALL-HUGGER DESK

(Continued from page 178)

top laminate such as Formica. We chose Harvest Gold, but any color can be used.

To collapse the drop leaf, the hinged leg is folded up underneath and held by a small latch bolt. The telescoping leg should slide smoothly but not be loose. If it binds, it may be necessary to add thin cardboard shims to the spacer blocks at the top. Adjust the fit so the leg just slides freely when the wingnuts are loosened. Tighten the nuts to lock it at the desired height.

The upper cabinet is 12 in. deep and rests on 12-in. shelf brackets. While most brackets are sturdy enough to support its weight, it's a good idea to screw the cabinet to the wall tracks to help carry the load and prevent any tendency for the cabinet to tip forward. With the cabinet positioned at the desired height, locate a pair of screws in the wall tracks behind it near the top, remove the screws and drill matching holes in the back of the cabinet. Then run the screws through the back and into the same holes in the wall tracks. If necessary, use longer screws than those supplied to assure a firm grip in the wall anchors.

The bullet lamp is fastened to the door with a short $\frac{1}{8}$-in. pipe nipple. The wire runs through the door and is stapled along the back side to the hinge point, using insulated staples. Form a loop in the wire where it passes around the hinge to allow some slack. This permits the door to be opened and closed without the lamp cord interfering with its operation. (Note: While this method does not conform to accepted code practice for permanent house wiring, it is adequate in this case because the wall cabinet is not considered a permanent part of the house.) The fluorescent fixture is wired through a surface-mount duplex receptacle that provides a switch for controlling the light, plus an extra convenience outlet for plugging in an electric pencil sharpener, desk lamp or other appliance.

The cabinet is finished in walnut-toned Formica with Harvest Gold laminate on the door to match that on the desk. Not counting incidental hardware and scrap lumber, you can build the basic units for about $60, including the Formica (half a 4x8 sheet each of the walnut and gold). The bullet lamp, a Sears Model 34 A 8702, is about $15 and the two-tube, 24-in. fluorescent fixture about $12. These bring the total cost to approximately $87. If you wish to eliminate the Formica and go to a painted finish, you can save about $35, but the laminate is well worth the expense as it hides joints, simplifies construction and adds a slick, marproof finish to the project. ★★★



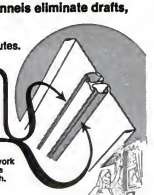


Many variations are possible using adjustable shelf brackets in slotted wall standards. Shelf over desk (left, above) has a stock plastic Rubbermaid kitchen drawer screwed underneath for storing pencils and other small office supplies. Magazine rack (right) rests on sloping brackets sold ready-made for this purpose.

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IN-A-CHEST HOME OFFICE

(Continued from page 79)

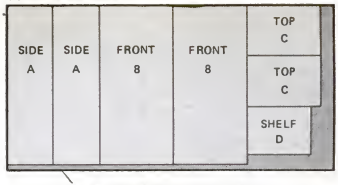
bottom of the cleat for attaching the desktop with 1¼-in. No. 8 fh screws. Screw holes are also made across the plywood back and in the top of the metal file cabinet, although the desktop is not permanently installed at this time.

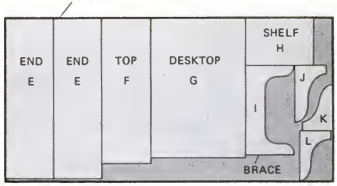
Except for being right and left-handed, with the left wing having a shelf at the bottom, both wings are made alike. Parts A measure 14⅝ x 46⅝ in. and have a ½ x ¾-in. rabbet along the front edges to accept parts B, which measure 21-3/16 x 46⅝ in. The latter are glued and nailed in the rabbets with finish nails and checked for squareness. Parts C measure 14⅝ x 21-7/16 in. and are rabbeted (⅜ x ¾ in.) along two edges to fit over and flush with the top edges of parts A and B, then glued and nailed. Part D (the wing shelf) is secured with ¾-in.-square cleats glued and screwed to parts A and B. Screw holes for attaching shelf brace L are drilled through parts B and D for screws driven from the front and up from the bottom.

The actual length of part I is determined by the width of the file cabinet. In the original it measures 14 x 26¾ in. and is anchored in place by a cleat at one end and the file cabinet at the other. Two holes

(Please turn to page 186)

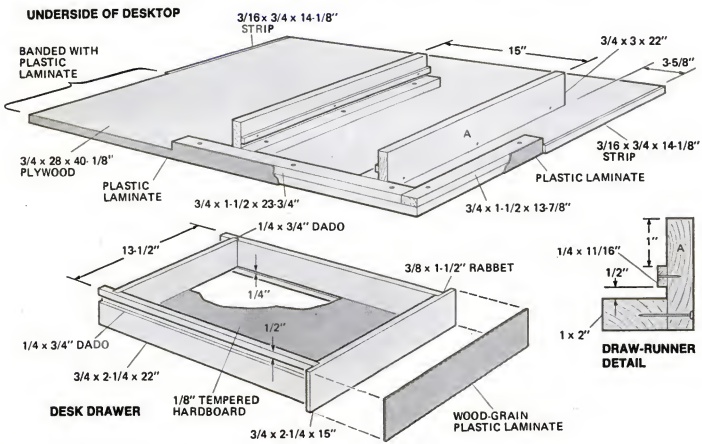
CUTTING SCHEDULE





ACTUAL CUTTING SIZES

(A) ¾ x 14⅝ x 46⅝ in.—Wing sides
(B) ¾ x 21-3/16 x 46⅝ in. Wing fronts
(C) ¾ x 14⅝ x 21-7/16 in.—Wing tops
(D) ¾ x 12 x 18¼ in.—Wing shelf
(E) ¾ x 14⅝ x 47⅝ in.—Chest ends
(F) ¾ x 14⅝ x 43 in —Chest top
(G) ¾ x 28 x 40⅞ in.—Desk top
(H) ¾ x 14 x 21 in.—Typewriter shelf
(I) ¾ x 14 x 26¾ in.—Brace
(J) ¾ x 9¼ x 16 in.—Typewriter-shelf brace
(K) ¾ x 9¼ x 12 in.—Typewriter-shelf brace
(L) ¾ x 9¼ x 11 in.—Wing-shelf brace



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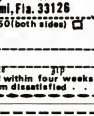
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IN-A-CHEST HOME OFFICE

(Continued from page 182)

are drilled through the side of the cabinet for screws from the inside.

The 14 x 21-in. swing-away typewriter shelf consists of parts H, J and K, asembled as detailed on page 79. Parts J and K are glued and screwed along adjacent edges of part H. A 10-in. length of piano hinge is used to hinge the assembled shelf to a ¾ x 2 x 10-in. wood block, which is later screwed and glued to the inside of part E, 26 in. up from the floor.

Now you are ready to cover the various parts and assemblies with plastic laminate. The original was covered with Formica's English oak, No. 343, finish No. 64. It will take approximately two and a half 4x8-ft. sheets.

If working with plastic laminate is a new experience for you, we refer you to *How to Work With Plastic Laminate* (page 154, March '70 *PM*) which explains how to cut, cement and trim the material. The most professional (and fastest) trimming job is done with a portable router, using special cutters, but it can be done with a special hand tool made by Arlyn Industries, 6921 Stride Ave, Burnbay 3, B.C., Canada.

Only part L is covered with laminate on both sides, others just on the edge and one side. In each case, the edges are banded first. A good place to start is on parts D and L since these, particularly part L, must be screwed in place before part B can be covered on the outside. In the case of the wings, the extra width that the 1/16-in. laminate adds has been accounted for in the overall sizes given for parts B and C. Inside surfaces not covered with laminate were painted olive green, as was the file cabinet. Here it's wise to paint the back panel of the center section before assembling the desk.

When all parts are covered with laminate, you can start putting the desk together. First lay the center section on its back and position the file cabinet against the ⅛-in. hardboard strips. Use two C-clamps to hold the cabinet in place and drill two screw holes through the sheet metal opposite each hardboard strip. Drill two more through the back of the file cabinet and the plywood back. Use ¾-in. No. 8 rh wood screws into the hardboard strips, and ¾-in. stovebolts through the plywood back.

Next install the desktop by turning screws up through the left-hand cleat, through

holes in the top of the file cabinet and holes in the plywood back. Add the typewriter shelf by screwing the block to which it is hinged to part E at a point 26 in. up from the floor. The shelf should clear the desk drawer by ¼ in. Part I is added next and is held with screws inserted through its cleat, the side of the file cabinet and the back.

Wings are hinged last with 46¼-in.-long plywood back.
piano hinges. It's best to hold the wings in their open position by clamping them temporarily to the sides of the center section. Hinges are surface-mounted, with the barrel centered over the joint.

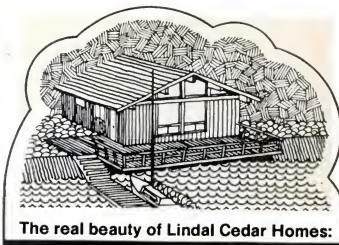
The striker plate from a lockset is used to align the two wings with the top of the center section when they are swung shut. Two magnetic catches, screwed to the underside of the desktop at the front, are used to hold the doors shut. A third magnetic catch is used to hold the typewriter shelf closed, while an elbow catch is used to lock the shelf in open position. The plate for the magnetic catch on the typerwriter shelf is fastened to the plywood back with a short stovebolt. A pivoted doorstop is used to keep the left-hand door "locked" to the floor when the typing shelf is being used.

Twin paper-storage bins, and the four-drawer compartment, held in place by screws, are detailed on page 79. Large decorative towel rings are used for elegant wing pulls, and a regular 24-in. under-cabinet fluorescent fixture attaches to the underside of the drawer compartment. A roundhead screw in the center partition of the paper bins will act as a hook for a pinup lamp to spotlight the typing shelf. ★★★

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Companion side chair—Cat. No. C3KX7796N, olive green, Sears, Roebuck & Co.
Portable electric typewriter—Celebrity power 12, Cat. No. 3H5360N, Sears, Roebuck & Co.
Plastic laminate—English oak No. 343, No. 64 finish, Formica Corp., 120 East 4th St., Cincinnati, Ohio 45202.
Pinup light—Handymate PN-2, walnut, Swivelier Co., Inc. Nanuet, N.Y. 10954.
Wing pulls—Antique brass Chateau No. BF117 towel rings, Kirsch Co., Sturgis, Mich. 49091.
Paint—Velour semigloss alkyd enamel, olive green, Devoe Paint Co., Inc., 2 Oxford Drive, Moonachie, N.J. 07074.
File cabinet—two-drawer, full-suspension with lock, 15 x 28 x 29¼ in. Modern Steelcraft Co., 1101 Linwood St., Brooklyn, N.Y. 11208.
Door holder—5 in. dull bronze, No. J1235 DEZ, The Spartan Works Ltd., 27 Ludlow St., New York, N.Y.

While materials for this desk cost about $265, you can build it for considerably less by painting the outside instead of covering it with plastic laminate, and by buying a used file cabinet instead of a new one. You could also save on the towel-ring handles and the lamps.



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(Continued from page 149)

static valve in the air cleaner snorkel that is controlled by a temperature sensor in the air cleaner. This valve permits control of carburetor air to allow leaner carburetor calibrations and thereby reduce emissions.

Check the operation of this valve by starting a cold engine. Look inside the snorkel. The valve should be closed. As the engine begins to warm up, the valve should open and be fully opened when the engine reaches normal operating temperature. If not, the entire system must be checked.

Fuel system. How's the rest of the fuel system? Other areas that can cause hesitation include a fuel pump which is failing, a carburetor float level that is set too low or carburetor passages that are plugged with dirt. Is it time for a complete carburetor overhaul? If yours hasn't had one in 30,000 miles or so, and hesitation is your problem, do the job.

Here are a few more things to check:

Air leaks into the fuel intake system will lean out the fuel mixture and can result in hesitation, as well as rough idle.

If you have a vacuum gauge, hook it up and let your engine idle after it has warmed up. The engine should be set to idle at the manufacturer's recommended rpm. If the vacuum-gauge needle holds steady at an extremely low reading (much less than the 19 to 21 inches that is considered normal), an air leak probably exists at the carburetor or intake manifold. If you don't have a vacuum gauge, just tighten all carburetor and manifold bolts.

Distributor vacuum advance unit. Check for damaged vacuum advance by removing the distributor cap, pulling the vacuum line off the vacuum inlet of the vacuum chamber, moving the distributor plate against its rotation and holding a wet finger tightly over the vacuum inlet. The distributor plate should remain in position. If it snaps back, the diaphragm in the vacuum chamber is probably leaking. Replace the vacuum advance unit.

Ignition timing. Flat-spot acceleration will result if timing isn't adjusted to manufacturer's specification. Check timing with a stroboscopic timing light.

Other possibilities. Less likely, but possible, causes of hesitation are incorrect distributor point gap and dwell, sparkplug gap and condition, and ignition coil output. Check 'em out. ★★★

SELECTING A MODERN SCATTERGUN

(Continued from page 137)

with ranges between 25 and 40 yards. "Full" chokes throw the tightest long-range patterns best for 35 to 50-yard shots when hunting large wary game such as wild turkeys or pass shooting at ducks and geese.

☐ *Gauge designation* tells relative diameter of the barrel. Largest capacity gauges have smallest numbers.

10-gauge: Uncommon today. Found only in a few double-barrel shotguns.

12-gauge: The most popular gauge. Appropriate for all target shooting and hunting; best choice for the one-shotgun man who hunts a variety of game.

16-gauge: Declining in use, superseded by heavier loads in some 20-gauge shells.

20-gauge: Good choice for upland game where faster, lighter handling helps. Adequate for ducks over decoys; not for pass shooting. Lighter recoil aids beginners, ladies.

28 gauge: Fast handling with no noticeable recoil, but light shot charge restricts it to experienced gunners hunting small upland birds at short range.

410 gauge: Light shot charge is more likely to cripple than down game. Best reserved for target use or pests of barn-pigeon category. Don't choose 410 for beginners; it's a difficult tool, for experts only.

☐ *Magnum* shotguns in 12 and 20 gauges will take larger shells that open to 3 inches after firing, rather than the standard length of 2¾ inches. Heavier shot charges give greater range.

☐ *Rifled slugs* fit any shotgun, are slightly more accurate in skeet or improved cylinders. Slug barrels with rifle sights are available.

☐ *Selection* should be based on good feel and fit of gun, recommendations of friends, considerable shopping and catalog study. A good dealer can order specific models. Young beginners might start with a 20-gauge pump with shortened stock. For waterfowling, pick 12 or 12 magnum pump or autoloader. Same gun with interchangeable barrels or adjustable choke, or 20-gauge magnum, is a good all-around choice. For short-range upland game, a 20-gauge is suitable, while long range requires 12-gauge or 20-gauge magnum.

And the best buy? An American 12-gauge pump action with interchangeable barrels or adjustable choke probably offers the most for the money. ★★★

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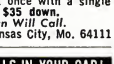
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GRADE CROSSINGS TAKE DEADLY TOLL

(Continued from page 142)

train. "The random pattern is to prevent the light from being ignored," he explains. "Random signals are more disturbing than periodic or rhythmic ones. The motorist should be disturbed and alerted."

One positive result of the Congers, N.Y., tragedy is a new warning system developed by Solitron Devices, Inc., an electronics firm located but a few miles from the scene of the crash. The system is composed of two units—a small radio receiver installed in a school bus or other motor vehicle, and a transmitter in the locomotive. The transmitter sends out a signal for a predetermined distance (a radius less than 20 city blocks is adequate). The signal, picked up by the receiver, triggers the warning system.

The driver is alerted by a series of attention-getting beeps and by the word TRAIN, in large red letters, flashing on and off on a dashboard unit. The driver can't turn the unit off, and the beeping and flashing continue until the train has passed out of the area.

The unit in the motor vehicle is expected to cost less than $100, while the train's transmitter system will run under $300, according to Benjamin Friedman, Solitron's president.

"We were all deeply affected by the accident," explains Friedman. "Some of our employees' children were on that bus. We set out to utilize our technological expertise to develop a means of preventing this kind of carnage in the future."

The FRA and the National Traffic Highway Safety Administration recently began a project to determine the feasibility of various train-to-motor-vehicle types of warning systems.

Former Secretary of Transportation Volpe sums up the grade-crossing problem in blunt words: "All of us have the same reaction when we hear of an accident between a motor vehicle and a train. Why in this period of advanced technology must such primitive accidents occur? I have asked myself that question many times and, frankly, I am not satisfied with the answers. There is no excuse for these kinds of accidents. They must not be allowed to continue." ★★★

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ROTARY CUTTERS FOR OFFBEAT JOBS

(Continued from page 152)

used to shape the teeth. (Unhardened drill rod is easily sawed and filed.)

The little "saw" cutter has four teeth, two being filed like the teeth on a crosscut saw, one set slightly toward the shank and the other toward the tip to provide clearance. The other two teeth were filed like those on a rip saw, and similarly set. Teeth were positioned by first marking saw slots 90° apart.

Tooth shape. After a cutter has been turned and the teeth approximately formed, it is necessary to provide relief by removing metal behind each cutting edge. At the same time, it generally is desirable to remove metal from in front of each edge, so the edge will strike the work with more of a shearing action. If suitable milling cutters (or grinding wheels) are available, these operations can be performed at the time the blank is notched. Otherwise, the tooth can be shaped by careful filing and smoothed with abrasive stones, or by grinding. If you intend to finish-grind the cutter after hardening, sufficient metal should be left during other forming operations.

After a cutter has been shaped, except for final touch-up with a grinder, it is hardened and tempered. For ordinary high-carbon drill rod, hardening can be done by heating to a cherry red, quenching in cold water, polishing a "test" area, reheating until the polished spot turns a light yellow (straw) color and cooling in water. ★★★

INSTALLING CAR STEREO SPEAKERS

(Continued from page 124)

a grommeted hole for the wire. If the wedge has an open bottom, cutting a larger hole under the speaker will give you better bass response, by letting the trunk act as a resonator.

But wedge speakers can obscure rear vision, and their plastic cases can warp in sunlight. So flush-mount speakers are usually preferred (and many wedges' grilles and speakers can be disassembled and flush-mounted, if you prefer).

Most American cars now have 6x9-inch speaker ovals cut in the metal frame under the rear shelf, often with the deck's fiber covering perforated to form a grille. If your car lacks these perforations, you'll have to cut the fiber. A sharp knife does the cleanest job, but the speaker grille should cover ragged saw-cut edges. If the metal is not precut, you'll need a hacksaw or sabre saw. Window overhangs make sabre saws impossible to use from above the shelf on many cars, but if so, you can get in the trunk and cut upward from there. Speaker attachment holes can be poked through the fiber with an icepick; if you have to drill the metal yourself, drill from inside the trunk until the metal is holed, then finish with the icepick. Bolting the speakers in place is easiest if you have a helper in the trunk to hold the speaker nuts and lockwashers as you tighten the screws from above.

Rear-deck speaker grilles should be dark to avoid annoying reflections and preferably not be plastic, which can warp. But metal grilles' small holes (or those in some deck perforations) can focus the sun's rays like pinhole lenses, sometimes damaging speakers. Here's where an ounce of prevention (or an ounce of grille cloth) is worth lots of cure. Before attaching a metal grille, cover its underside with speaker grille cloth. Cut the cloth to fit the grille and tack it in place with beads of cement around the grille edge.

If you're wiring stereo speakers in both the front and rear of the car, use identical speakers mounted at identical heights for best sound balance. Add-on front-rear stereo balance controls may cause distortion in some installations, but they're cheap, so try them if you like. Four-channel tape decks (and some stereo ones) have built-in connections and balance controls for four speakers. ★★★

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HOW TO FIT A FAIRING AND RIDE A RACER!

(Continued from page 168)

snap. The racers came up with expensive one-piece, cast-alloy mags to replace wire wheels and, predictably, the bucks-up racer sports the same.

The most sensational modification is the addition of a fairing. These can be divided into roughly three classes—the full fairing, which extends from a clear wind-screen right down under the engine; a bullet-shaped half fairing, or the more traditional Harley or BMW-style shield-type half fairing; the latter disdained by cafe racers who consider that style the province of "full dresser" riders.

In most states where rear-view mirrors are required on road bikes, the fairings must be rigged with mirrors, and there are as many solutions as there are fairings. One cafe racer we tried had sports-car-style mirrors that looked good, but they were mounted so low on the fairing that we skinned our knuckles on them everytime we turned a corner.

The dividing line between the purely cosmetic "cafe racer" and the truly functional machine comes in the decision of the builder to move the braking and shift linkage pedals further aft where the pilot's feet will be. You can still ride a bike with clip-ons with the foot-brake pedal and shift lever in the stock position, but you lose reaction time in moving your foot forward to activate the controls. It's a lot of work to move these controls back but that's the only way you can make a cafe racer really functional.

The American trend toward cafe racers caught most of the world's bikemakers by surprise and, at this writing, only Triumph has anything that approaches a cafe racer —a new model called the Hurricane that has a seat-molded-into-the-gas-tank one-piece unit designed by American fairing designer Craig Vetter. Moto-Guzzi, the big Italian firm just bought by Alessandro De-Tomaso, is said to be introducing a factory cafe racer and the Japanese will not be far behind.

But now's the fun stage, as it is with any emerging recreational trend. Making a cafe racer out of a "Kwacker" (Kawasaki) when no bolt-on parts exist is a lot more challenging to do-it-yourself bikers than buying a Dunstall Norton cafe racer ready-made.

Although many cafe racer parts are foreign-made, the American motorcycle accessory manufacturers are getting hip fast and soon domestic choices of fairings, solo seats, clip-ons, extractor exhausts and the like will outnumber the foreign offerings. Following is a list of some of the suppliers of cafe-racer hardware:

Avon Fairings, Box 327, Athena, Ore. 97813.

Chariot Cycle Ltd., 303 Selkirk Ave., Winnipeg, Man.

Commanche Products, Rt. 2, Box 136, Clearview Rd., Cottontown, Tenn. 37048.

Dick Pearce Garage, 729 South Central, Los Angeles, Calif. 90021.

Harry Hunt, 23 San Bruno Ave., Brisbane, Calif. 90045.

Hooker Headers, 1032-TF West Brooks St., Ontario, Calif. 91762.

Kerker Raving Products, Box 4152, Glendale, Calif. 91202.

Kintab, 128 West Chestnut, Monrovia, Calif. 91016.

Kook's Custom Headers, 401 Suffolk Ave., Brentwood, N.Y. 11717.

Monotrack Engineering, 959A West 17th St., Costa Mesa, Calif. 92627.

Paul Dunstall, Well Hall Rd., London SE9, England.

U.S. Dunstall dealers:

- Boston Cycles, 124 Brighton Ave., Boston, Mass. 02134.
- Competition Cycle Center of the South, 1421 North Dania, Fla. 33004.
- Firth Motorcycles, 1857-9 Danforth Ave., Toronto, Ont.
- Moto Sports, 1988 Pearl Rd., Brunswick, Ohio 44212.
- Motor Cycles Unlimited, 5768 Paradise Drive, Corte Madera, Calif. 94925.
- Sport Centre, 6027 Whittier Blvd., Los Angeles, Calif. 90022.
- Super Motorcycle Center, 8508 Hampton Blvd., Norfolk, Va.
- YBM Sales Inc., 572 West Lancaster Ave., Bryn Mawr, Pa. 19010.

Paul Kinch Co., 5 Cardiff Rd., Luton, Bedfordshire, England.

Sonicweld, 14547 Arminta, Unit J, Van Nuys, Calif. 91402.

The Fiberglas Works, 3921 Portola Dr., Santa Cruz, Calif. 95060.

Trabaca Products, 837 West 18th St., Costa Mesa, Calif. 92627.

Trackmaster Frames, 14646 Blythe No. 28, Van Nuys, Calif. 91402.

Vetter Fairings, Box 216, Urbana, Ill. 61801.

Webco Inc., Box 429. Venice, Calif. 90291.

Weber Cams, 310 South Center, Santa Ana, Calif. 92703.

Wheelsmith Engineering, 3635 West McFadden, Santa Ana, Calif. 92704.

Yoshimura Racing, 2190 Shasta Way, Simi Valley, Calif. 93065. ★★★

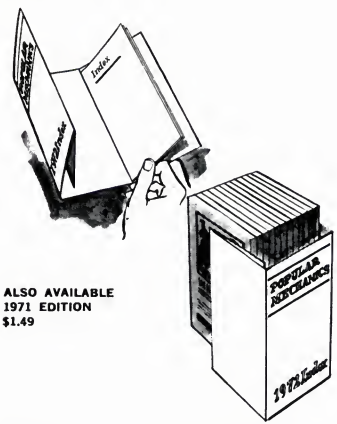


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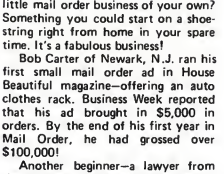
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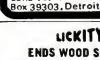
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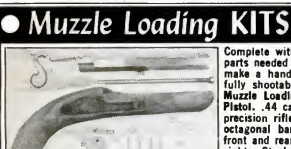
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(Continued on next page)

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(Continued from preceding page)

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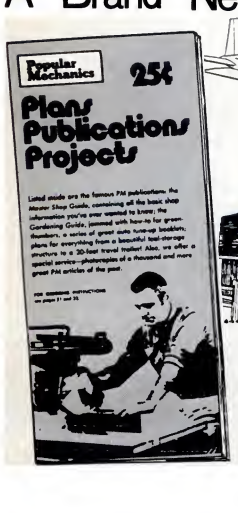
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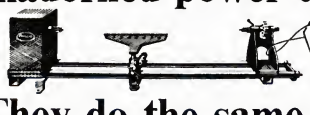
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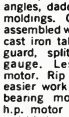
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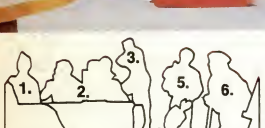
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